Concrete

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# Brick Tests and Clay Opinions

THERE is much ado about brick—particularly concrete brick. Most of the excitement seems to be due to the fact that concrete brick—a recent product forced to prove its right to public favor—has been scientifically compared with ancient and honorable clay brick, and the comparison conclusively proved the superiority of concrete.

A recent series of tests on clay and concrete brick made at Columbia University was reported in CONCRETE for May. The rub of the whole matter is in the fact that concrete brick show higher efficiency; that is, concrete brick of given strength show much higher percentages of that strength when built into piers than do clay brick. This is the chief bone of contention, if we may believe a spokesman for the clay brick manufacturers, writing in *Engineering News-Record* for June 28. Says he, in part:

> Because the comparative tests of clay and concrete brick piers made recently by Columbia University were conducted under conditions which differ widely from current practice in the field, the Common Brick Manufacturers Association rejects the test results. The U. S. Bureau of Standards was asked to conduct, at the earliest possible moment, comparative tests on clay and concrete brickwork so that the construction industry might have the *truth* as to the real properties of each kind of material.
>
> Although the tests were made on brickwork supposed to represent New York city practice, the mortar was 1:3 portland cement mortar. The report does not state that any lime was used and presumably there was none. The New York Building Code, however, specifically permits a certain percentage of the cement in cement mortar to be replaced by lime and this is typical of building codes throughout the land.

Referring to photographs of the tests at Columbia, reproduced herewith, the writer says:

> I would be content to leave it to the good judgment of these men (practical masons and others familiar with practical brickwork) as to whether, with a pure cement mortar mixed in the proportions of one part of portland cement to three parts sand, they ever, in the whole course of their experience, saw brickwork laid up with such full and perfect joints as those shown in the illustration. You will note that every joint is absolutely full of mortar in spite of the fact that cement mortar works "short."

As to the ability of plaster or stucco to adhere, this statement is made:

> Your readers will also recall that it is much simpler to apply plaster or stucco to a brick wall than to concrete.

The writer in *Engineering News-Record* obviously rests his case on these statements, which are conspicuous by the absence of any attempt at technical proof. The spokesman has made a sales talk, and thoughtful engineers, architects and builders will receive it as such. But what are the facts?

Both clay and concrete brick specimens were treated *identically* in the Columbia tests. The entire series was conducted with utmost regard for the practical conditions under which masonry is constructed and used in New York city. A thoughtful reading of Bulletin No. 2 reporting the series makes these observations perfectly evident. Likewise, the bulletin impresses one with the sincerity and impartiality with which the investigation was made. In it Columbia University has furnished a mass of indisputable scientific evidence thoroughly supporting its conclusions.

The public has a reasonable amount of faith in Columbia University and in the New York building department, which cooperated officially and actively in the Columbia tests.

More tests by the Bureau of Standards, if the clay brick manufacturers want them, will be welcome, but it is evident that the manufacturers of concrete brick, like the general public, are satisfied with the Columbia investigations and now consider the burden of the proof as resting with the clay men. It is our understanding that the Bureau of Standards now has results of a series somewhat similar to that made at Columbia, which will be forthcoming shortly. Will the Common Brick Manufacturers Association lend its assistance in having these results made public at the earliest possible date?

### ABOUT MORTAR

The mortar used in the Columbia investigation was 1:3 cement and sand mortar, the standard prescribed by the New York Code of 1906 which is still in force. Recently the use of 15% of hydrated lime has been permitted. This quantity is recognized as not sufficient to change the physical characteristics of the mortar except to slightly reduce its strength. Readers will be interested to know that in spite of the statements quoted above, 1:3 cement and sand mortar is well recognized in the pamphlet "The Strength of Ordinary Brickwork" recently issued by the Common Brick Manufacturers Association. (Copy may be obtained on request to that association, 2121 Discount Building, Cleveland, Ohio.) From page 2 comes the accompanying illustration showing a specimen of clay brick work taken from the Racquet and Tennis Club Building, New York, which shows the "well filled joints" which the clay writer claims do not occur in practice. Under the illustration the statement appears that "There was nothing unusual about the character of the brickwork." In the description below, this statement is made: "*The mortar used was, according to Mr. George V. Brown, superintendent for the contractor who erected the building, a straight cement mortar mixed in the proportion of one part cement to three parts sand. Portland cement was used.*"

The circular referred to quotes the leading tests on clay brick masonry in America and Europe, several of which were made at Columbia; so clay promoters would have us understand that some Columbia tests are

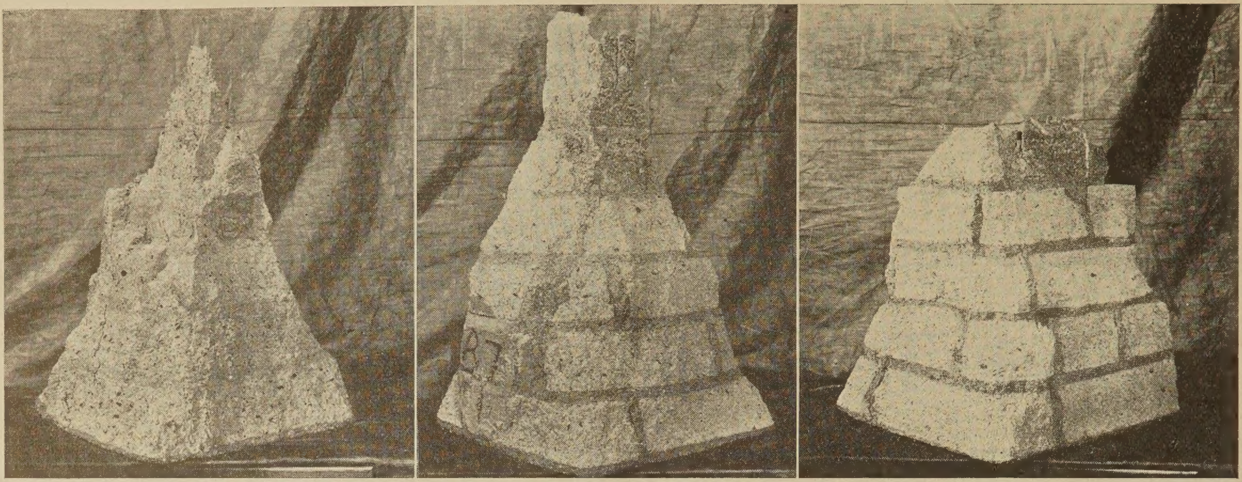


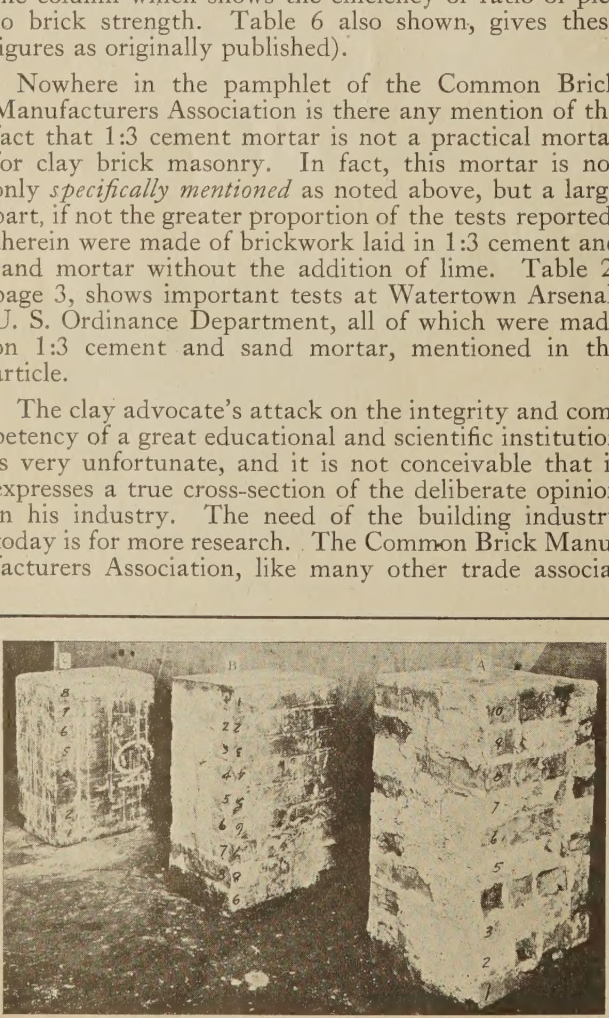
Plate 4 from Columbia Test Report, Republished from Concrete for May, 1923, Showing Typical Fractures of Concrete Brick Piers

acceptable and some are not. (It may be observed that the highest efficiencies reported for clay brick masonry occur in the "Comparative Tests of Clay and Concrete Brick Masonry" by Columbia University (in May 1923 Concrete) the series to which the clay writer takes such violent exception. To Tables 2 and 5 (from the clay publication) reproduced here, we have added the column which shows the efficiency or ratio of pier to brick strength. Table 6 also shown, gives these figures as originally published).

Nowhere in the pamphlet of the Common Brick Manufacturers Association is there any mention of the fact that 1:3 cement mortar is not a practical mortar for clay brick masonry. In fact, this mortar is not only *specifically mentioned* as noted above, but a large part, if not the greater proportion of the tests reported, therein were made of brickwork laid in 1:3 cement and sand mortar without the addition of lime. Table 2, page 3, shows important tests at Watertown Arsenal, U. S. Ordinance Department, all of which were made on 1:3 cement and sand mortar, mentioned in the article.

The clay advocate's attack on the integrity and competency of a great educational and scientific institution is very unfortunate, and it is not conceivable that it expresses a true cross-section of the deliberate opinion in his industry. The need of the building industry today is for more research. The Common Brick Manufacturers Association, like many other trade associations, has eagerly collected the results of university research work and made them available to the public through its bulletins. The great help received from data so derived has impressed many people with the value of scientific research and the desirability of encouraging investigation.

Perhaps the most effective way to discourage investigation is for an industry, when disappointed with the results of a particular piece of research, to attack the investigators. Scientific men naturally dislike and seek to avoid the odium of trade controversersies. Most investigations of a practical and conclusive nature are sure to uncover truths fortunate to some and possibly unfortunate to others. The knowledge that any conclusions reached would lead to attack, could have but one effect—that of discouraging investigation in our colleges.



Test Piers from Raquet and Tennis Club Building

TABLE 2

Tests on Brick Piers at Watertown Arsenal, U. S. Ordnance Department

| Brick Used | Age | | Ultimate Strength lbs. per sq. in. | | Per Cent Efficiency |
|---|---|---|---|---|---|
| | Mo. | Days | Pier | Brick | |
| Light hard, sand struck | 2 | 12 | 900 | | |
| Hard, water struck | 5 | 22 | 3,422 | 12,880 | 26.6 |
| Light hard, water struck | 5 | 5 | 1,565 | 5,828 | 26.9 |
| Hard, sand struck | 1 | 0 | 1,800 | 11,340 | 15.9 |
| Light hard, sand struck | 6 | 0 | 1,519 | 6,598 | 23.0 |
| Hard, sand struck | 6 | 0 | 1,800 | 5,248 | 34.3 |
| Light hard, sand struck | 6 | 0 | 1,224 | 4,474 | 27.4 |
| Hard, sand struck | 6 | 0 | 1,411 | 5,808 | 24.3 |
| | | Average | 1,705 lbs. sq. in. | | |

TABLE 5

Tests on Brick Piers at Stockholm, Sweden

| Mortar Mixture | | | Crushing Strength Pounds per sq. in. | | | Per Cent Efficiency |
|---|---|---|---|---|---|---|
| Cement | Lime | Sand | Piers | Brick | Mortar | |
| 1.00 | 0.00 | 3.00 | 1,980 | 4,040 | 2,620 | 49.0 |
| 0.43 | 0.85 | 3.00 | 1,930 | 4,040 | 1,640 | 47.1 |
| 0.67 | 0.33 | 3.00 | 1,700 | 4,040 | 1,280 | 42.1 |
| 0.50 | 0.50 | 3.00 | 1,840 | 4,040 | 695 | 45.5 |
| 0.33 | 0.67 | 3.00 | 1,420 | 4,040 | 355 | 35.1 |

TABLE 6

Tests on Brick Piers at University of Illinois

*By A. N. Talbot and D. A. Abrams*

| Brick | Brickwork | No. of Tests | Age Days | Strength lbs. per sq. in. | Efficiency per cent | |
|---|---|---|---|---|---|---|
| | | | | | Brick | Mortar |
| Shale | Well laid | 3 | 67 | 3,365 | 31 | 117 |
| Shale | Well laid | 2 | 181 | 3,950 | 37 | ... |
| Shale | Poorly laid | 2 | 68 | 2,920 | 27 | 105 |
| Clay | Well laid | 2 | 62 | 1,060 | 27 | 37 |

# Finishing the Interior Concrete of Grauman's Metropolitan Theatre, Los Angeles

By William Lee Woollett
Architect, Los Angeles, Calif.

GRAUMAN'S METROPOLITAN THEATRE and office building, Los Angeles, Calif., recently completed, is noteworthy for the number of unusual structural features involved, the boldness with which these features were treated and solved and for the almost startlingly original uses and applications of concrete in the treatment of the theatre interior. The building, constructed entirely of reinforced concrete, is 13 stories high, 155 ft. x 240 ft. in plan. Mr. Woollett here gives us his conceptions of the uses of concrete, as he has employed the material with very rich architectural results on this work. Next month the outstanding structural features will be described fully in an article based upon notes from the designing engineer. These features include a cantilever balcony construction carried by a 126-ft. girder; 126-ft. span trusses, carrying the auditorium roof and the five floors of offices above; double core columns supporting these trusses; a heavy truss over the proscenium arch which carries the ends of the beams supporting the five floors of offices; two cantilever footings at the ends of the stage, each carrying six columns; and the marquise extending 12 ft. from the building wall.

The entire structure required 2,700 tons of reinforcing steel, 84,000 cu. yds. of concrete, 127,000 bbls. of cement and 1,500,000 ft. of lumber. The girder supporting the balcony carries a load of 2000 tons and two openings are provided for the ramps leading to the balcony. The auditorium trusses weigh about 5 tons each per lin. ft. and carry a load of 750 tons. The bottom of the balcony girder is reinforced with 204, 1¼-in. rods. This one girder contains 570 cu. yds. of concrete and 110 tons of steel.

The building was erected for the Hill Street Fireproof Building Co. For the theatre proper and lobbies, and all their interior treatment, William Lee Woollett, architect, Los Angeles, was the designer. For the building as a whole, the structure, its mechanical equipment and exterior, Edwin Bergstrom, Los Angeles, was architect. The concrete construction was designed by R. C. Mitchell, engineer for Edwin Bergstrom. The Winter Construction Co. was the general contractor, and E. Ceriat was contractor directly under Mr. Woollett for the decorative concrete of the interior of the structure.—Editor.

The methods and results in the use of concrete in Grauman's Metropolitan Theatre of Los Angeles to an extent, at least, have been of an experimental nature. I have used exposed masses of concrete in the interior of theatres before and had learned that agreeable textures could be obtained by treating the raw concrete in various ways and also that the methods were permanent and economical and therefore practical.

The proper use of concrete as a finishing material is intimately dependent upon the finishing of the concrete after the forms are removed. Without such finishing the material is practically hopeless for interior purposes. Therefore, the architect must coordinate the knowledge of the material and its ultimate treatment just as the architect, who intends to use marble for inside finish, provides for finishing, polishing, etc., and so with other materials.

It follows therefore that a practical discussion of concrete as a finished building material must include data as to the technique of its finishing. The concrete may be left exactly as when the forms are removed. In the Grauman Metropolitan Theatre, for instance, nearly all of the concrete of the trusses over the auditorium and the beams and cantilevers on the mezzanine floor, and the proscenium opening with its flanking columns, are in concrete left in the original color, except for limited areas which were colored with pigments or metallic glazes. An all-over coat of very thin asphaltum will suffice to remove the appearance of newness. So little color or metal was applied to these surfaces that they count in color as raw concrete. These surfaces are far from the eye and were left purposely grey so that the color effects in the lighting scheme could be made effective, incidentally. There is no more effective medium for electrical display than the neutral tones to be obtained in raw concrete.

For nearby surfaces ordinary lead and oil paint is a good medium, dragging over it either color in oil or color mixed with benzine or turpentine. If the surfaces are sufficiently far from the floor areas, to be free from the accidents occasioned by cleaning and dusting, water color will serve the purpose. It is also practical to coat the concrete with a good varnish and pounce the color into the varnish.

It is commonly known that the chemical reactions which take place in freshly formed plaster or concrete affect pigments which are applied to these surfaces and it has been my custom to use only pure color mixed with lead or zinc, so far as possible, looking forward with expectancy to the action of the chemicals upon the pigments to produce an uneven and mottled appearance. One can modify the effects of the chemical reactions by using sizing, depending upon the amount and character of the reactions desired.

It is sometimes necessary to paint the walls in a fuller color and with stronger contrasts than one would if one were not expecting the fading due to the action of the chemicals in the wall. It is also possible to bring out designs in the wall through the use of resistants. This method of depending upon the accidents and chemical reaction might be deemed rather unscientific, as the exact amount of fading can never be estimated. I have found, however, that for the purposes of theatre construction, where we are dependent upon artificial light entirely and where we use a great deal of colored light, the variation due to uneven chemical action is not so great as to be a factor, for it is always possible to compensate for the lack of any color in surfaces by supplying it through the medium of light.

In regard to large areas which must be colored in a satisfactory manner, the rough surfaces of the concrete are much cheaper to handle than ordinary smooth

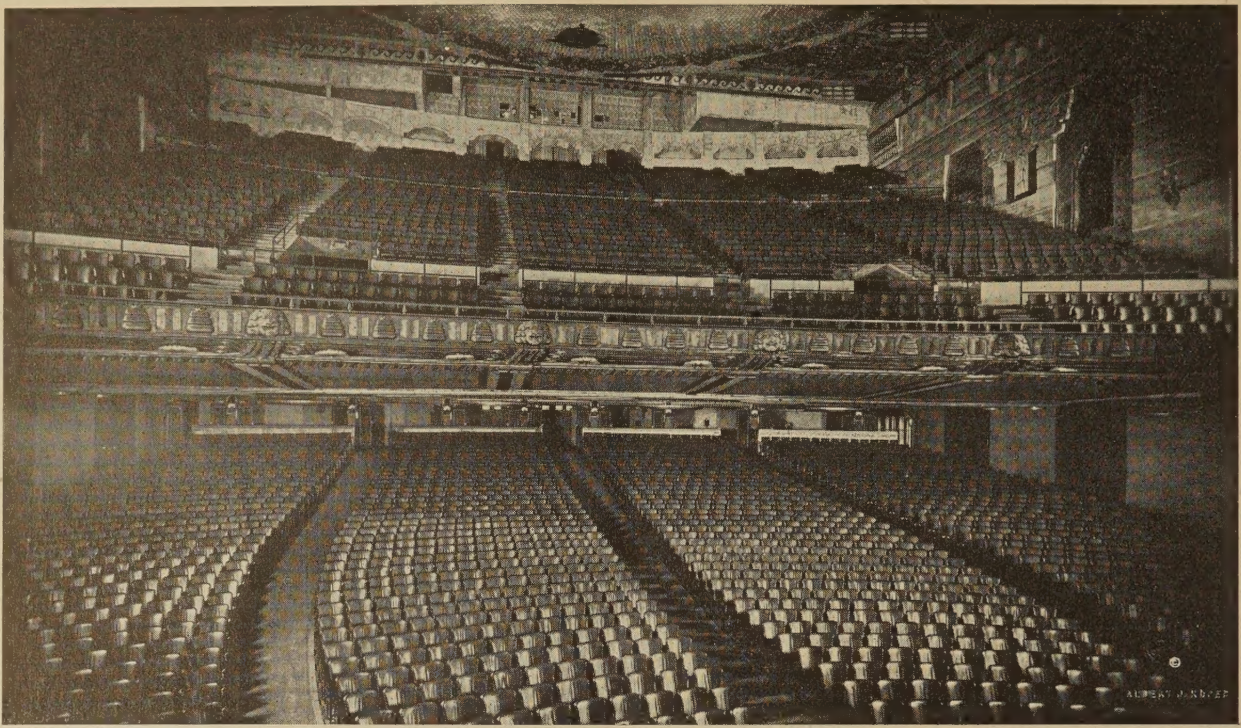


Fig. 1—Grauman's Metropolitan Theatre, Los Angeles. William Lee Woollett, Architect

plaster surfaces, produced by the ordinary method. Decorators spend a great deal of time and money in producing what is called "Tiffanying" on plain wall surfaces. This "Tiffanying" process produces variation of color. In method there is nothing mysterious in "Tiffanying," i. e., a body tone with one or two superimposed tones in the form of glaze perhaps, which, where pounced with a dry brush or cloth, gives a cloudy or stippled effect. To do "Tiffanying" on concrete surfaces is a simpler operation than on a plain plaster surface.

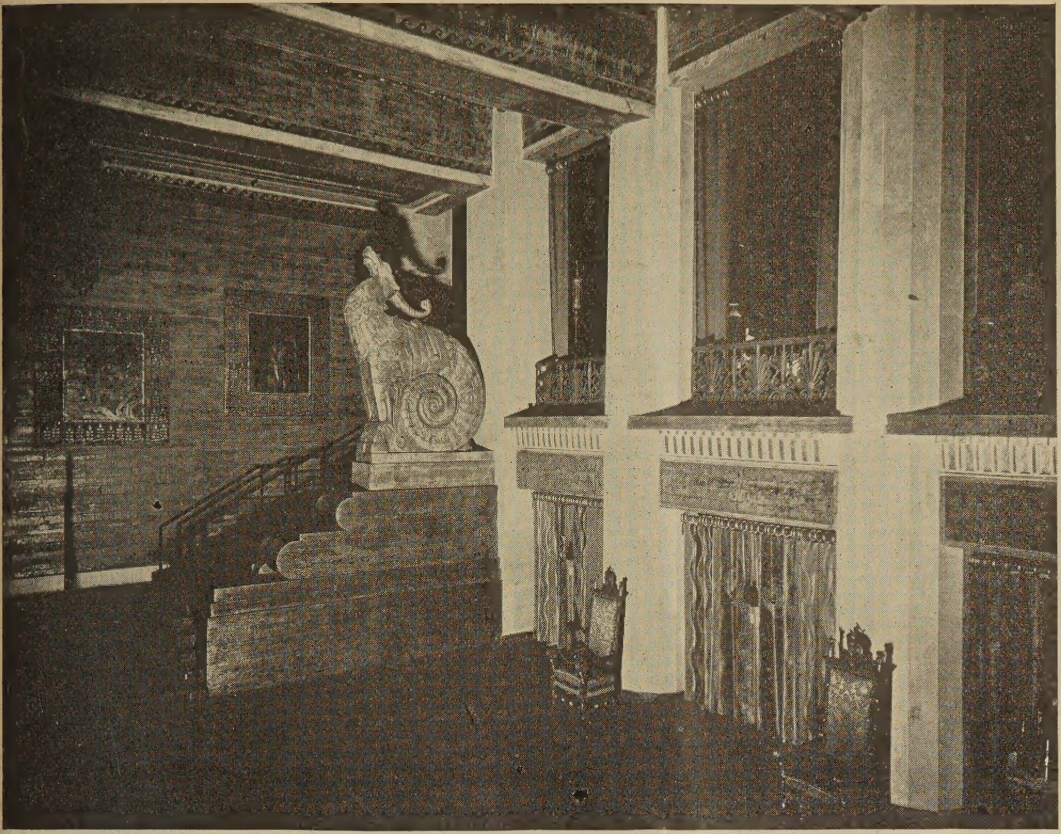
An interesting effect is obtained on concrete by first applying a body tone and after it is dry, dragging the surface in such a manner that only the projecting areas are covered with a second coat—or the process may be reversed by painting on the second coat and rubbing off the high lights. The projecting surfaces may be dragged in another direction with still another color, or the second dragging or first dragging may be done with shellacs, varnishes, beeswax or paraffine, according to the effects desired. In addition to the varying tones so easily obtained on rough concrete, one also obtains the sense of permanence of the material, which adds to the value of any work of art.

For concrete surfaces which are near the eye and which have been elaborately modeled, it is desirable to cover the entire surface with Dutch metal or aluminum leaf, or even with gold leaf, and afterwards apply color broken up in oil or mixed in turpentine, benzine or water, according to the effects desired. Sometimes we cover carved or modeled objects—such as the great lion in the foyer of the Metropolitan Theatre (Fig. 2) with alternate layers of Dutch metal and oil paint, also alternating varnish and shellac with Dutch metal and color, and sanding same to a glass finish, very much as one would finish a piano top. This process, if the concrete has been roughly cast, does not take away from the effect of the object being cast in concrete but does give beautiful surfaces which are friendly and effective. Concrete which we know so familiarly in the construction of buildings, culverts and bridges, dams, wharves, etc., is a very base material. From a psychological standpoint, it is not easily conceived as a finishing material. It is therefore necessary, in order to make it suitable for the use of beautiful interiors, so to treat it that one gets a friendly reaction from the contemplation of its surfaces so finished that ladies and gentlemen in evening dress need not feel that either they or the concrete are out of place. In fact, the surfaces should be treated in such a manner that one is tempted to come near them and when near them, experiences a sensation of wanting to touch them, in the same manner that one likes to put his hand on a beautifully polished piece of marble or bronze, or silk tapestry.

In the overcoming of the natural aversion to this material, the architect is necessary. The evolution of this material as a proper element in finishing the building depends upon the skill and understanding of the architect. For this material, as for all others, the architect must learn to fashion it into an agreeable, friendly element in the structure.

In using architectural forms, like pilasters, columns, cornices, etc., it should be borne in mind that the original architectural forms come to us down the lanes of antiquity, as stone forms. The carvings and moldings of architecture are due to the reactions induced by the attempt of architects and artists to make stone a beautiful building material. Concrete is very different from stone in its physical properties. It is impractical, for instance, to build a beautiful Corinthian capital out of concrete and show the delicate leafage and scrolls in exactly the same values with the same deep undercuts that one would expect to find in marble or other fine grain stone. Therefore, in making the designs for concrete work, it is necessary to have the nature of the material in mind so that there may be no duplication of forms which have been used in stone but new forms based upon the aesthetic values of concrete as a building material.

Concrete architecture should be designed in such a



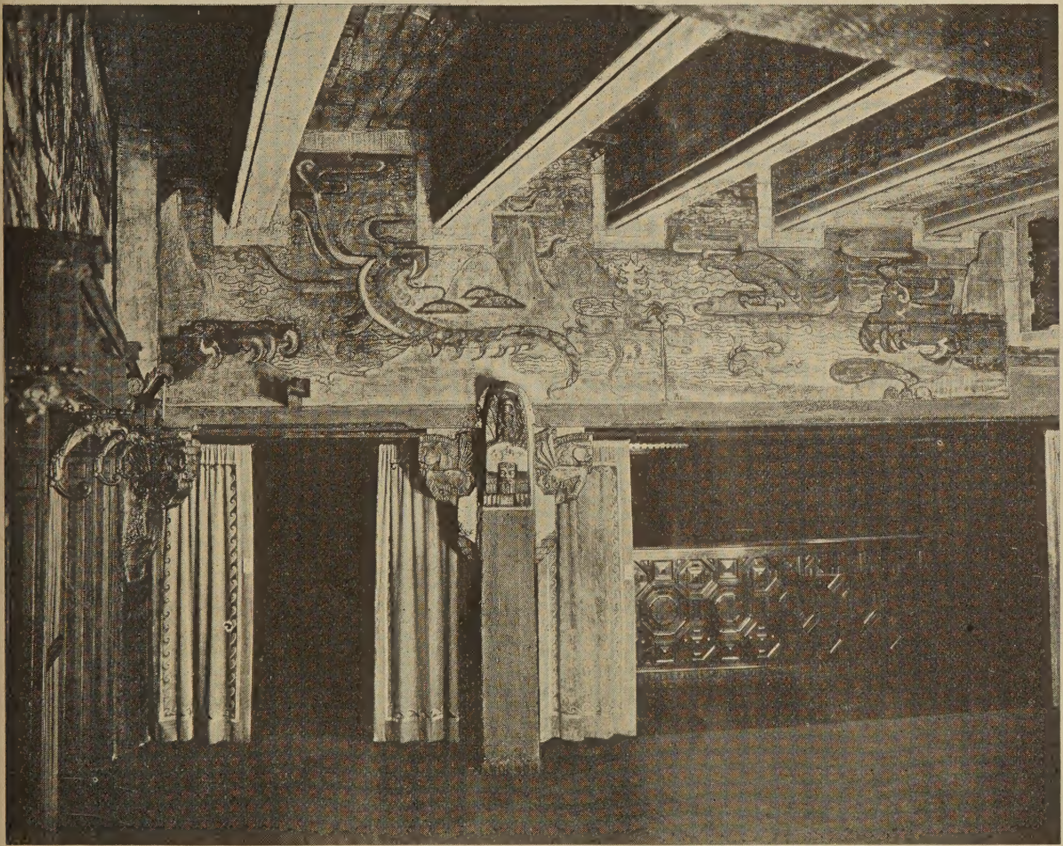


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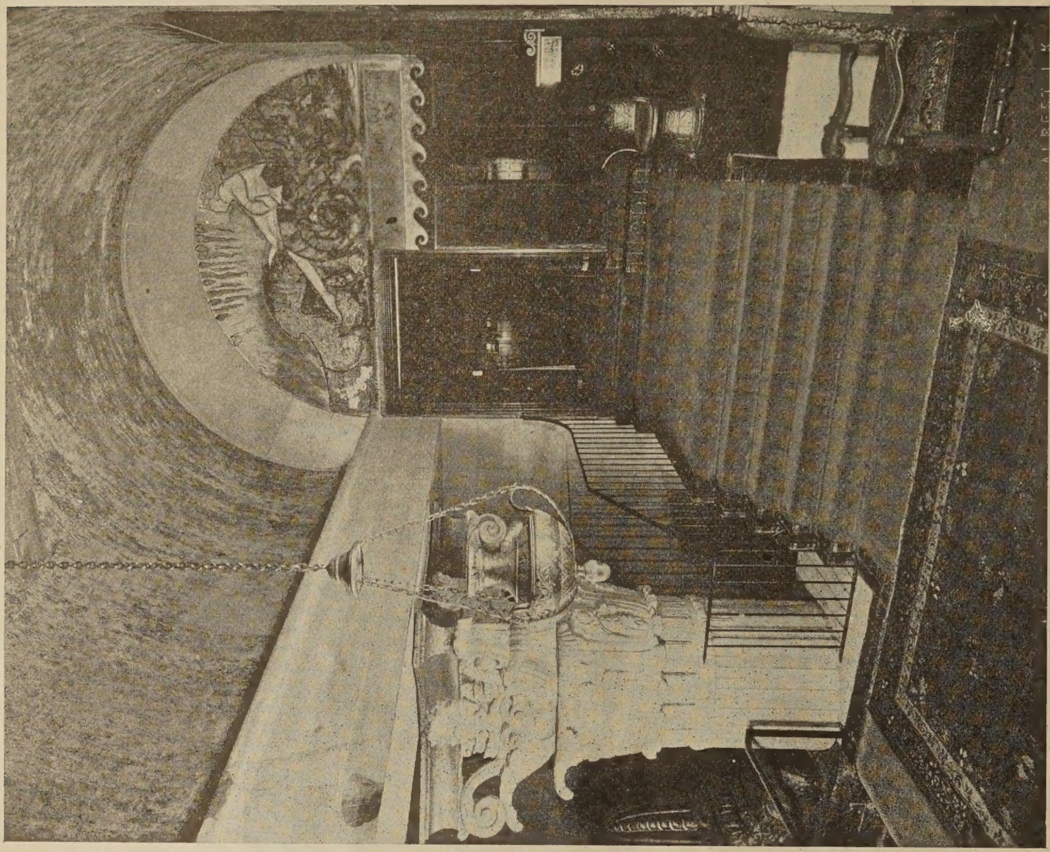
Fig. 2—Entrance Lobby. Side Walls, Beams and Stairway Newel in Rough Concrete; Decorations Applied Directly to Concrete

Fig. 3—End of First Floor Foyer. Side Walls, Beams, Columns and Column Ornaments in Rough Concrete. Decorations and Murals Applied Directly to Concrete. William Lee Woollett, Architect



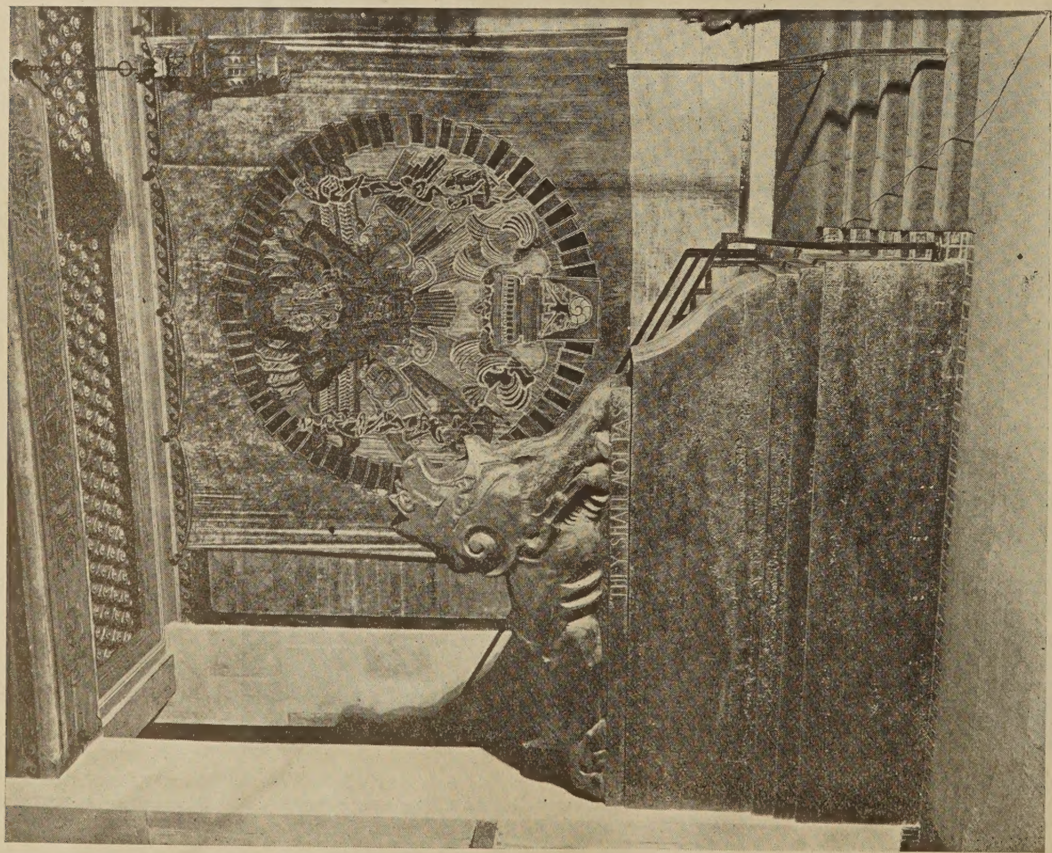


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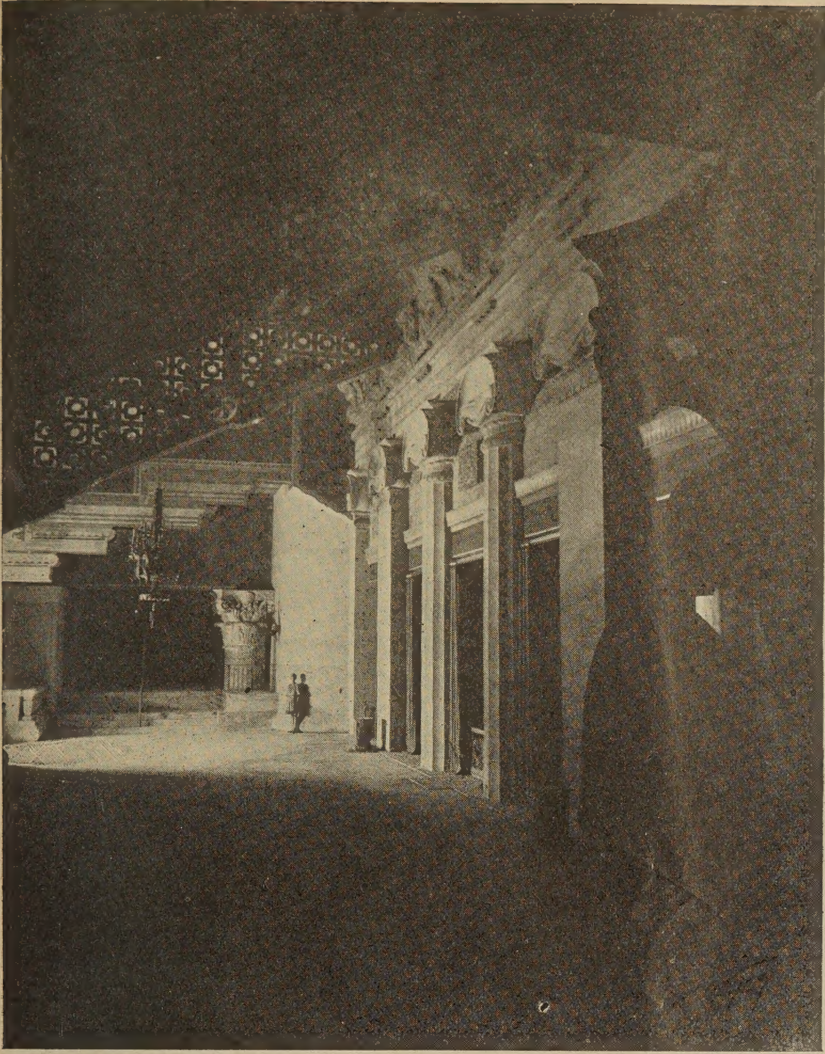
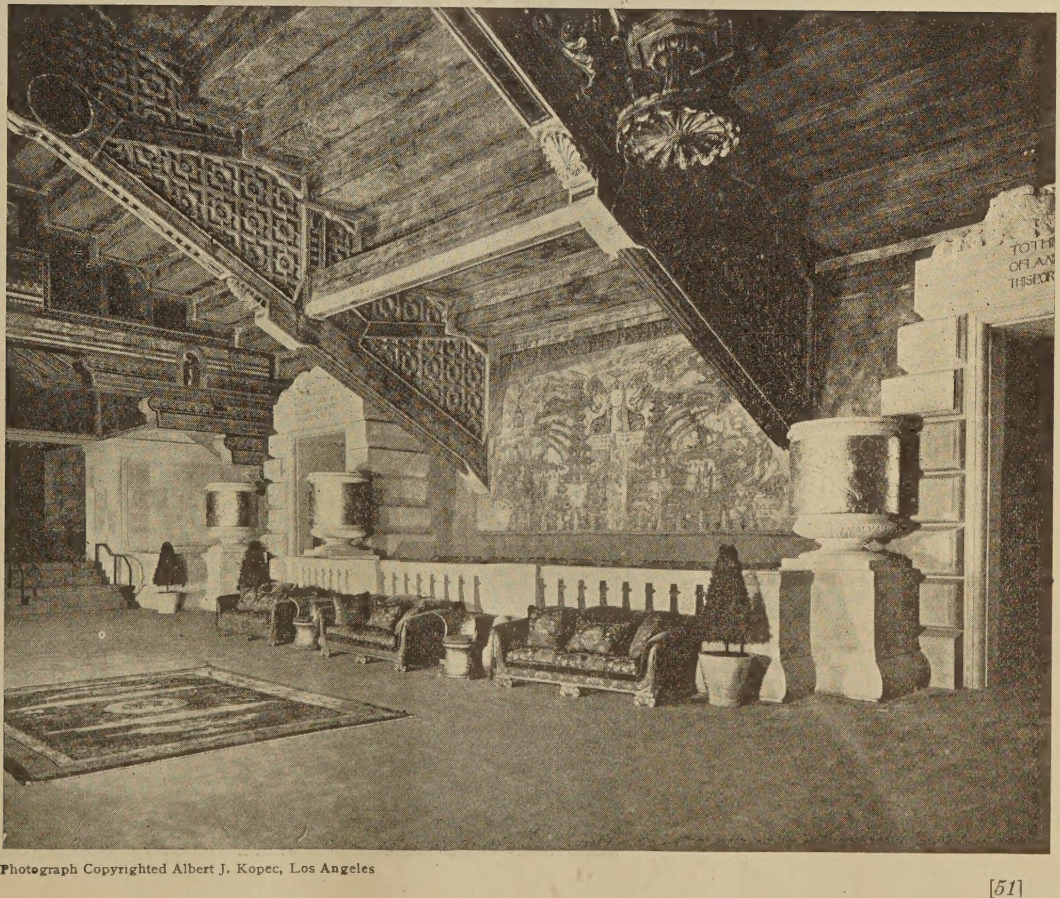
Fig. 4—Entrance Lobby at Left. See Also Fig. 2

Fig. 5—Concrete Cap from Choragic Monument Lysikrates, Athens, in Rough Cast Concrete. William Lee Woollett, Architect



FIGS. 6 AND 7—MEZZANINE, SHOWING REINFORCED CANTILEVER TRUSSES UNDER BALCONY, ENRICHED WITH ARCHITECTURAL ORNAMENTS AND COLORED DECORATIONS. WILLIAM LEE WOOLLETT, ARCHITECT



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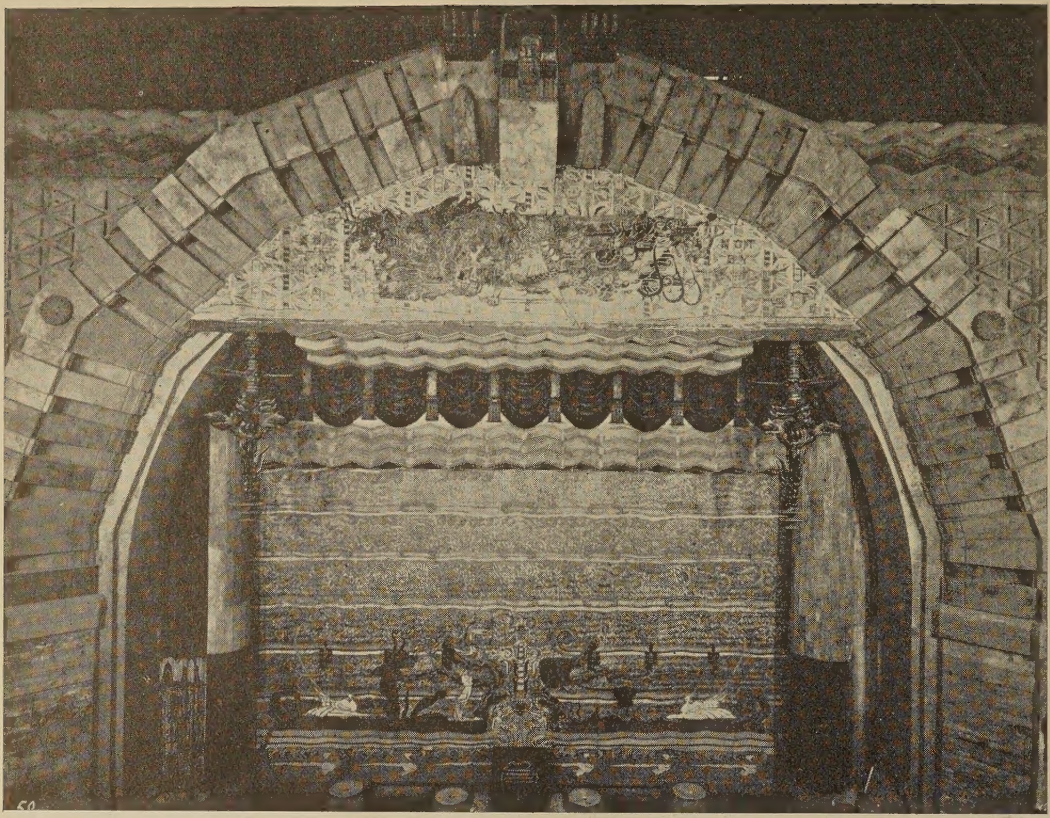

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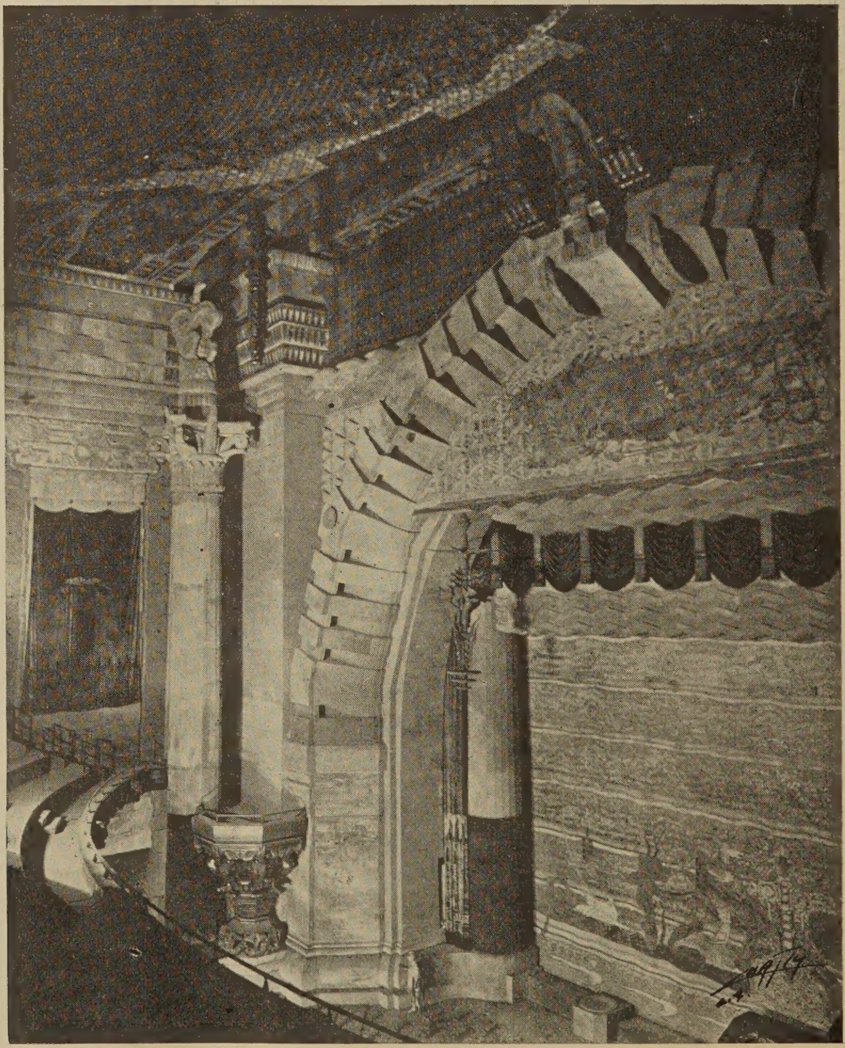
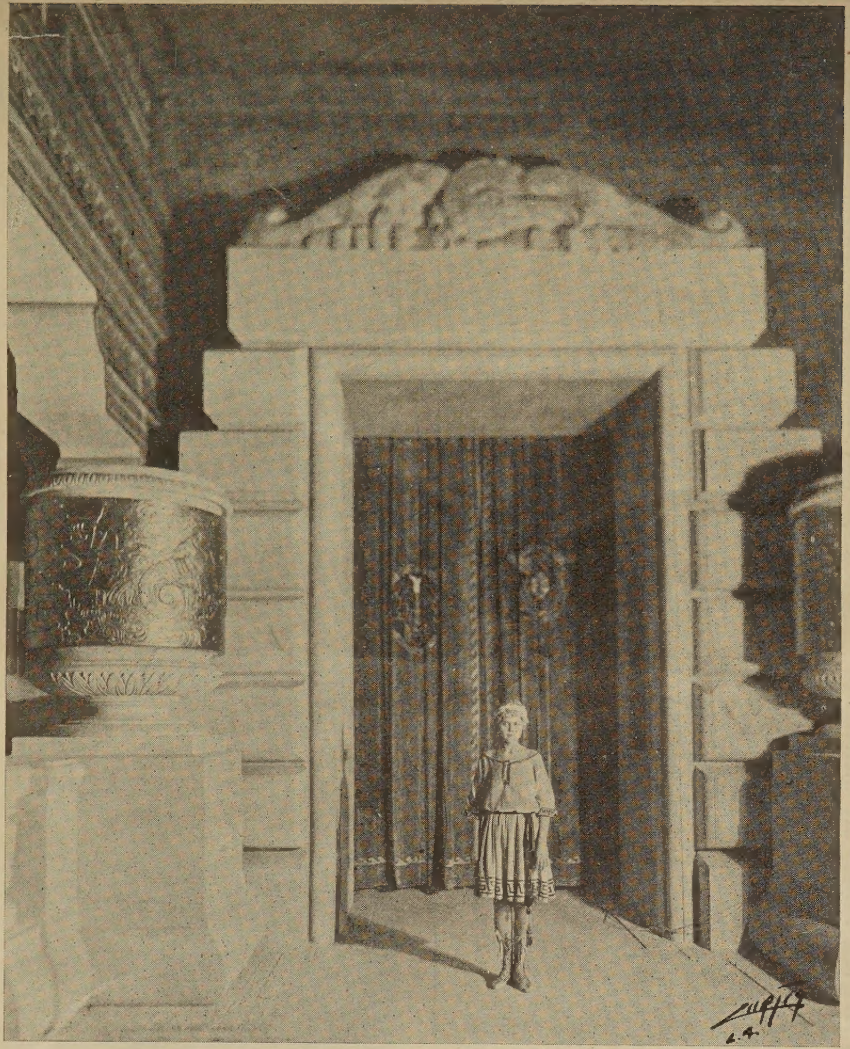
FIGS. 8 AND 9—PROSCENIUM ARCH. MURAL OVER PROSCENIUM OPENING IS ON CANVAS, APPLIED TO ROUGH CONCRETE SURFACE OF BEAMS SUPPORTING ORGAN LOFT





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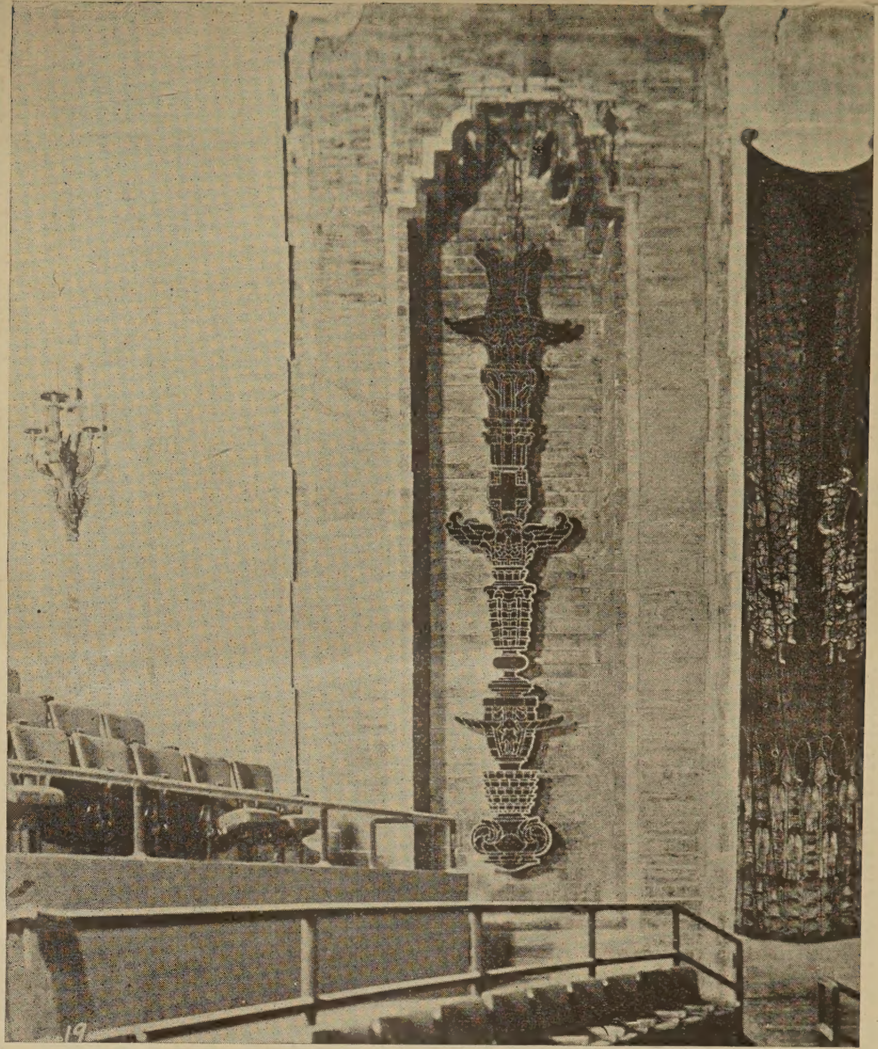


Fig. 10—Entrance to Balcony

Fig. 11—Niche on Side of Auditorium, Showing Rough Concrete Construction, with Color Applied to Unfinished Concrete and Employing Black Leaded Glass for the Relief Design. William Lee Woollett, Architect

way that when one looks at the architectural members one realizes that the material is concrete. Concrete is thus dignified and recognized as a legitimate building material and the thought of stone or marble is no longer there. It is this translating of old architectural forms into forms suitable to a new material which is difficult. Architects are naturally feeling their way cautiously and we have, therefore, today, what might almost be called a transitional style of architecture. We are obliged to follow the old forms closely in order not to get so far away from precedent that we give the impression of being illiterate or bizarre.

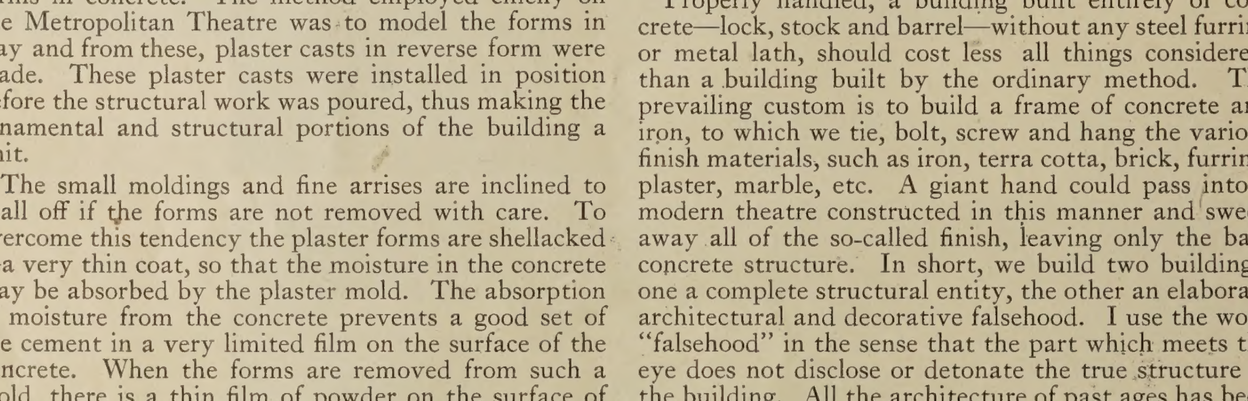
An illustration of my point is the architecture of our forefathers of the Colonial period. Many examples of this style were built in wood entirely, some of them of brick and stone with wood trimmings. Columns, pilasters and cornices and other features common to stone architecture were used in the embellishment of these homes. Of course the mouldings, etc., built out of wood, were not often exact duplicates of their architectural antecedents. The forms were more often greatly modified from the classic prototypes, so that they became true expressions of a wood architecture, but recalled in sentiment the classic formulae. In like manner, the architectural features of modern buildings in concrete architecture will probably recall but not duplicate the architectural forms of other ages.

There are various ways of reproducing architectural forms in concrete. The method employed chiefly on the Metropolitan Theatre was to model the forms in clay and from these, plaster casts in reverse form were made. These plaster casts were installed in position before the structural work was poured, thus making the ornamental and structural portions of the building a unit.

The small moldings and fine arrises are inclined to spall off if the forms are not removed with care. To overcome this tendency the plaster forms are shellacked—a very thin coat, so that the moisture in the concrete may be absorbed by the plaster mold. The absorption of moisture from the concrete prevents a good set of the cement in a very limited film on the surface of the concrete. When the forms are removed from such a mold there is a thin film of powder on the surface of the concrete form, composed of unset cement and sand. In order to liberate the more elaborate architectural ornaments from the plaster forms, it is wise to employ a skilled mechanic—a carver by preference—one who may be familiar with the contour of the architectural design, in order to save it from undue mutilation. Great care should be exercised in not making the reverse forms too heavy The heavier the form, the more difficulty of course in cutting it away from the finished product. The thinner forms make it possible for the mechanic to follow the design.

One of the greatest impediments to the use of new building material is the lack of knowledge on the part of contractors, artisans and workmen. Before satisfactory and economical work can be produced in any new type of construction or decoration, it is necessary to build up in the building trades, gradually, a knowledge of the effects desired. At present there is no considerable body of workmen in the community who understand proper manipulation of elaborate reverse forms for concrete, nor are there many decorators who understand the possibility of bringing the concrete to a satisfactory finish as to texture and color. Therefore, we find that whereas we might expect to produce an all concrete building at a very modern cost, it frequently occurs that due to the causes mentioned above, the costs are excessively high. In the Metropolitan Theatre we were fortunate in having contractors who were familiar with the methods, and were successful in letting a contract which included much of this reverse form work for $150,000, bids for which were received as high as $240,000 and $250,000. (Needless to say the successful bidder had for years been familiar with the type of work called for.)

Properly handled, a building built entirely of concrete—lock, stock and barrel—without any steel furring or metal lath, should cost less all things considered, than a building built by the ordinary method. The prevailing custom is to build a frame of concrete and iron, to which we tie, bolt, screw and hang the various finish materials, such as iron, terra cotta, brick, furring, plaster, marble, etc. A giant hand could pass into a modern theatre constructed in this manner and sweep away all of the so-called finish, leaving only the bare concrete structure. In short, we build two buildings: one a complete structural entity, the other an elaborate architectural and decorative falsehood. I use the word "falsehood" in the sense that the part which meets the eye does not disclose or detonate the true structure of the building. All the architecture of past ages has been more or less real in the sense that the construction and the decoration are part and parcel of each other and has expressed in one operation, the idea of building and the idea of beauty. We have yet to solve this definite problem, i. e., to express in beautiful forms, the type of construction thrust upon us by a utilitarian age.



Figs. 12, 13 and 14—Left to Right. Fig. 12—Same Cap Shown in Fig. 4, with Some of the Plaster Molds Still in Place. Figs. 13 and 14—One "of the Animals" Being Cast of Concrete in Plaster Molds. The Completed Work, Representing the Fleetest and the Slowest, a Deer and a Snail, is Shown in Fig. 2

# Broken Coral Reefs as Aggregate for Concrete

By R. J. Beaujon, Jr.
Bonaire, Dutch West Indies

Along the whole west and south coast of this island it is abounding with broken coral reefs which are washed ashore by the sea. Besides the millions of tons of this material, good coarse coralliferous sand is also found on the beach, which is very adequate for building purposes. These coral stones seem to be suitable aggregate for concrete for general work and are found in every size, so that the most capricious choice can be made in selecting the material.

The writer has used this aggregate for the construction of floors, covers for septic tanks, draining pipes, etc. with very good results. When experts can prove (based on proofs in other countries) that practically this material is reliable, it is believed that this coast, lying close to the main port, Kralendijk, will be the ideal place to erect plants of concrete block machines for the manufacturing of concrete products. There is anchorage all along the coast and the transportation by land is satisfactory.

### Concrete Salt Warehouse

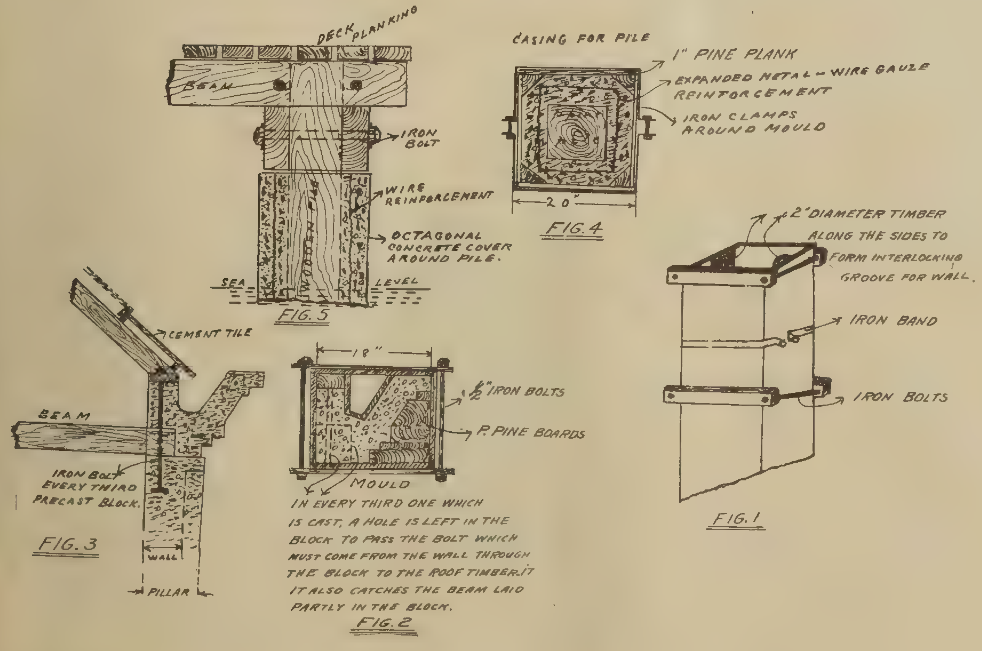
For making further experiments and with the thought of constructing the cheapest possible type of building, based on reliable construction and minimum upkeep expense, I made a trial with the construction of a small building for the storage of salt.

This building having a length of 56 ft. x 26 ft. wide was constructed by first pouring 20 equidistant concrete pillars 9 in. x 13 in. x 13 ft. of a 1:3:5 mix of concrete along the sides of the proposed building. The pillars extend 2 ft. under the ground. The wall panels which are interlocked in the pillars are 6 in. wide made of 1:3.5:5 mix. The forms were constructed as shown in Fig. 1. They were coated inside with fuel oil thinned with petroleum, and could be removed after 24 hours. This pillar row system has the benefit that the greatest care for making a good plumb wall is only necessary in the pouring of the pillars, while for filling the panels no particular skill is necessary. On the back side of this building a gallery was constructed with an additional part all of concrete adjoining two little wooden houses wherein the windmills for crushing the salt are located. The gutter on this building was made of concrete reinforced with heavy poultry fence-wire.

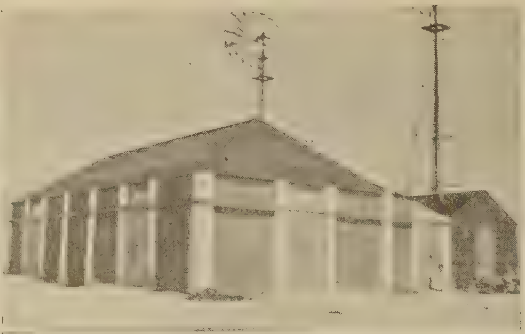
By excavating the foundation, it was found that the material dug up was sand and coral stones well proportioned by nature, so it was only necessary to add cement to this to have a first class concrete. The cost for aggregate thus reached the lowest possible figure.

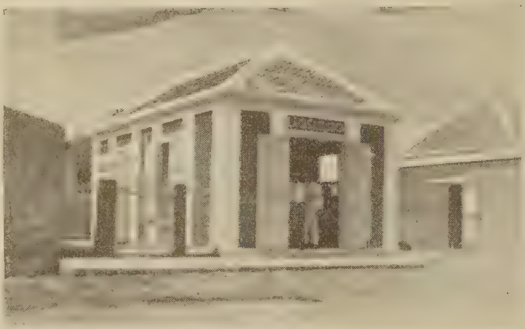
### Concrete House

A second trial had been made with a concrete house in the village where the cheapness of stone houses is proverbial. Here also the result was very satisfactory. I am sure that these two little buildings will serve as a guide for comparison of cost figures and there is no doubt that preference must be given to concrete houses in the near future if one considers the strength of the building, the minimum upkeep expenses and the little difference in building cost. Fig. 7 shows this little con-


DECK PLANKING
BEAM
IRON BOLT
WIRE REINFORCEMENT
WOODEN PILE
OCTAGONAL CONCRETE COVER AROUND PILE.
SEA LEVEL
FIG. 5
CASING FOR PILE
1" PINE PLANK
EXPANDED METAL – WIRE GAUZE REINFORCEMENT
IRON CLAMPS AROUND MOULD
20"
FIG. 4
CEMENT TILE
BEAM
IRON BOLT EVERY THIRD PRECAST BLOCK.
WALL
PILLAR
FIG. 3
18"
½" IRON BOLTS
P. PINE BOARDS
MOULD
IN EVERY THIRD ONE WHICH IS CAST, A HOLE IS LEFT IN THE BLOCK TO PASS THE BOLT WHICH MUST COME FROM THE WALL THROUGH THE BLOCK TO THE ROOF TIMBER. IT ALSO CATCHES THE BEAM LAID PARTLY IN THE BLOCK.
FIG. 2
2" DIAMETER TIMBER ALONG THE SIDES TO FORM INTERLOCKING GROOVE FOR WALL.
IRON BAND
IRON BOLTS
FIG. 1

Figs. 1 to 5—Details of Construction of Buildings and Piles





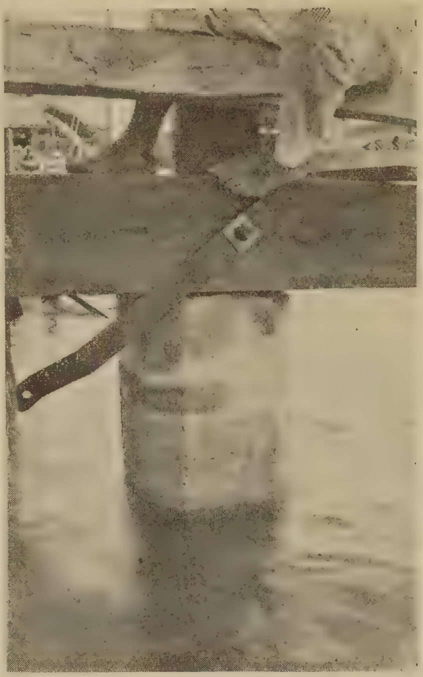


Fig. 6 (Upper Left)—Reinforced Concrete Salt House, Equipped with Mills for Grinding Salt

Fig. 7 (Lower Left)—Reinforced Concrete Store Building

Fig. 8 (Right)—Wood Pile Protected by Concrete Ring in Pier at Kralendijk, Bonaire

crete house which serves as a dry store. Figs. 2 and 3 show some construction details.

The third concrete construction which followed directly after the above mentioned is a small wharf at the port of this island, to replace a wooden wharf made on hardwood piles, which piles have become about 80% decayed and destroyed by pile worms.

The writer built a wall along the sides of the proposed pier for a length of 130 ft. in the sea, from the bottom to the sea level, of 1:3:5 concrete filled in second hand standard bean bags. The depth of the sea from shore to the outer end increases gradually from 1 ft. to 12 ft. To place the bags in line and to have the foundation well marked for the cleaning, a few boards were first fastened along the sides of the proposed foundation on a few 1-in. iron pipes driven in the bottom. With a shovel and a road rake a diver dug and cleaned the bed for the bags. These bags were placed crosswise and interlocking each other, the first layer being about 4 ft. wide, which thickness of wall continued nearly up to sea level. Gradually as the two sidewalls progressed the filling between these walls was done with big stones and debris. From sea level to the proposed height of the pier, wooden forms were placed upon the bag wall and a 15-in. concrete wall constructed. After laying the bags and before filling the wooden forms, 1-in. round iron bars had been driven at regular intervals through the bags for a depth of about 4 ft. On the upper parts of these iron bars which are placed as a kind of anchorage, double folded heavy poultry fence-wire was fastened for the whole length to serve as a light reinforcement. At the front where this wall is about 15 ft. high, extra heavy wrought iron pipes had been driven equidistant outside the wall. On these pipes 1¼-in. round iron cross-bars were placed. These pipes were further anchored with iron bars running along the sidewalls and fixed to another row of pipes driven about 15 ft. inside from the front face.

The completed fill received a finishing packing of the surface with a home-made concrete road roller, pulled by a 15 H. P. Avery tractor.

It is astonishing to see how quick a few workmen (two handling the bags above water line and tw placing them as required) can build such a wall a this depth. The two placing the bags remained fo an average of 20 seconds under water and the momen they came to the surface of the sea, they took bac another bag. After they had been placed for one week I have cut many of these bags on the edge to investigat the petrification and the results were very satisfactory Where the petrification had been disturbed by washin away of the cement at the edges, the loose aggregate which had fallen out did not reduce the thickness of th wall more than 2 in.

It is the writer's opinion that at a greater dept than 13 ft. where this construction was finished, i would be more economical to build on piles. Th remaining 50 ft. of this wharf was therefore constructe on 8-in. x 8-in. wooden piles, protected against pil worms by a concrete ring as shown in Figs. 4 and 5 Before putting the mould around the pile a precas reinforced block was slipped over the pile. Precas blocks serve as a foundation one foot below the bottom

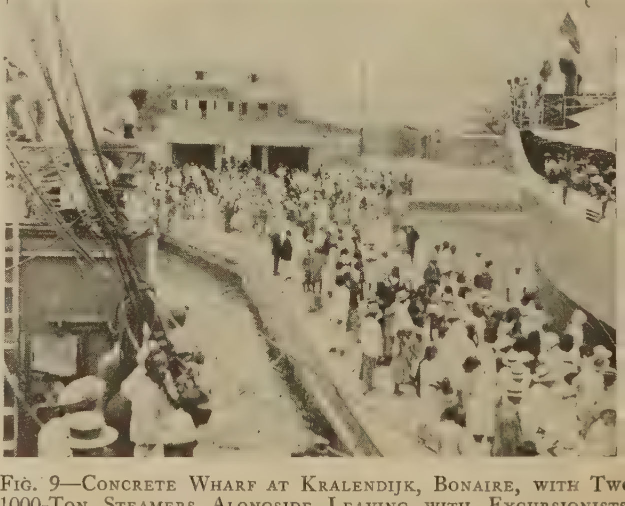


Fig. 9—Concrete Wharf at Kralendijk, Bonaire, with Tw 1000-Ton Steamers Alongside Leaving with Excursionists Dock Shows No Sign of Injury After Six Months Use

of the sea. No particular trouble was experienced in filling moulds. A clean, smooth, hard surface was found after removing moulds on the third day.

I hope we will soon overcome the idea prevailing in this locality that concrete construction is an expensive work, and look forward to the time when concrete structures will prevail and the immense quantity of aggregate which is so abundant here will yield good profit to the enterprising people.

# Precast Wharf Work on Manchester Canal

By Major Johnstone-Taylor
Shrewsbury, England

As most readers will be aware, Manchester, England, 30 miles from the sea is a port of considerable magnitude, this being possible by the Ship Canal. Since its opening some 30 years back, nothing has been spared to maintain the works in the highest state of efficiency and the new Trafford Wharf which replaces the original timber structure has been carried out on the thorough lines characteristic of this undertaking.

### Pre-Cast Work Mainly Employed

The special feature of interest is the use of pre-cast cylinders and boxes of reinforced concrete, special methods having been adopted for handling these which are of exceptional size. The actual wharf is built up of a double length of pre-cast reinforced concrete boxes these being mounted on two rows of reinforced concrete cylinders. The latter are bedded in the slope of the bank and rest upon the bed of the canal. A general section of the wharf is shown in Fig. 1. First there is the outer line of cylinders, *a* 6½ ft. in dia. with an approximate length of 28 ft. and a wall thickness of 4½ in. Back of these are other cylinders *b*, 9 ft. in dia. and ranging from 12 to 17½ ft. in length. They were all constructed on land nearby.

### Construction of the Cylinders

The reinforcement was erected around an inner form and the outer shell forms, made of $\frac{1}{16}$-in. plate stiffened by angle iron rings, were placed around in lengths and spaced so as to admit of the desired thickness of wall. The forms having been built up, concrete was poured in until the required height was obtained, the cylinders being subsequently stripped and left to mature, being finally placed in position by a crane. Before placing, however, a level foundation was prepared by a grab and steel piles of X-section driven into the bed as shown in Fig. 1 at *g*—*g*. These steel piles in conjunction with steel guides attached by a diver served to keep the cylinders concentric. When finally leveled up and centered the cylinders were sealed with concrete, the water was then pumped out and the whole finally filled solid with concrete, the tops being finally made level for the reception of the boxes forming the superstructure.

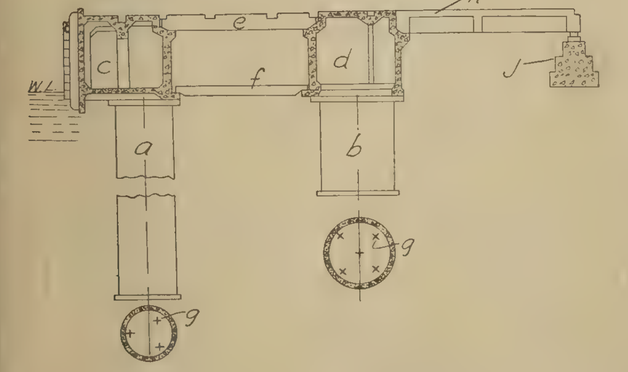


Fig. 1—General Section of New Trafford Wharf, Showing Two Lines of Cylinders

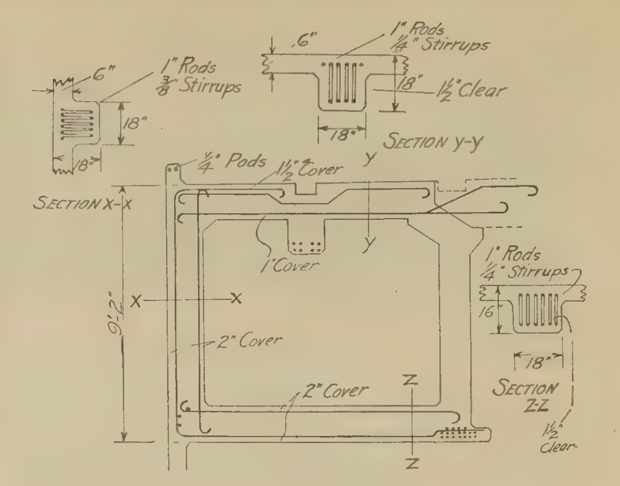


Fig. 2—Details of Outer Box Section

### The Pre-Cast Boxes

These are shown at *c* and *d* in Fig. 1. They are 25 ft. long, 11 ft. wide and 9 ft. high, those shown at *c* weighing some 63 tons and those at *d* somewhat less or about 58 tons. Details of the outer boxes are given in Fig. 2. Special forms and equipment were necessary for their construction some of which it is interesting to note came from the Blaw-Knox Co. of Pittsburgh, Pa. The boxes were cast as nearly as possible in the positions they were intended to occupy although a special crane had to be designed for getting them into position. It will be observed from Fig. 1 that when in place blocks *c* form a continuous subway, this serving to accommodate electric cables, hydraulic mains, etc. In between the inner and outer blocks are pre-cast beams *e* and *f*, these forming the roof and floor for a passage destined for conveyor belts to be installed for the purpose of handling grain in bulk. These beams have a span of 11 ft. and are 3 ft. 8 in. wide. They are grouted together in position and the floor slab asphalted. It will be observed that the floor line is just above water level.

### Transit Sheds to Complete the Job

The old wharf was used mainly for the handling of imported timber, but in connection with the new one large five story transit sheds are contemplated. The fronts thereof will actually be carried by the wharf. That is to say the floor of the first bay of the sheds will consist of reinforced concrete beams *h* bridging from boxes *d* to foundation blocks *h* both of which in common with the rest of the structure are pre-cast work.

Altogether the job forms an interesting example of this method of construction, by means of which the expense and trouble of cofferdams has been entirely avoided, the whole work being successfully carried out without accident or undue difficulty of any kind.

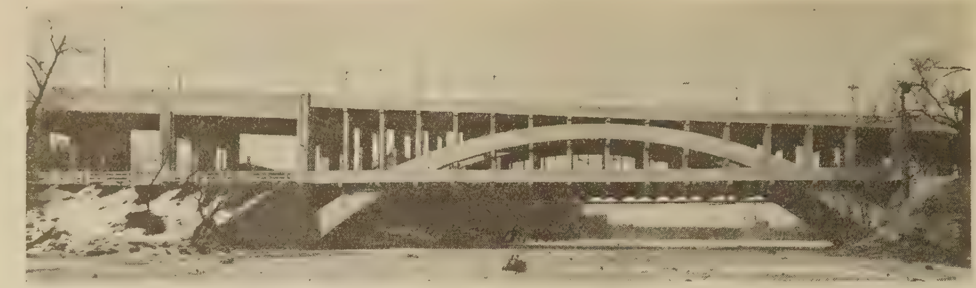


Fig. 1—Double-Deck Highway Bridge at Watertown, N. Y.

# Concrete Arch Bridge With Double Decks

In the design of the concrete highway bridge at Watertown, N. Y., as described in *Contractor's Atlas*, published by the Atlas Portland Cement Co., a clever use was made of the adaptability of concrete by making the bridge of double-deck construction. The upper deck carries the heavy traffic of Court and Coffeen Streets over the Black river and also across the railroad which parallels the river. The lower deck carries lighter traffic of River and Newell Streets, which are parallel to the river and north of the railroad.

The bridge is carried over the river on four reinforced arch ribs, the upper deck being supported by open spandrel construction and the lower deck being hung from the arch rib. The arch ribs are 6 ft. wide and 5 ft. deep, so spaced as to give two 12-ft. roadways and two 4-ft. sidewalks on the lower deck. The river span is 195 ft. and the height of the arch rib above the springing line 38 ft. The lower deck is 22 ft. below the upper deck. The span across the railroad is 86 ft.

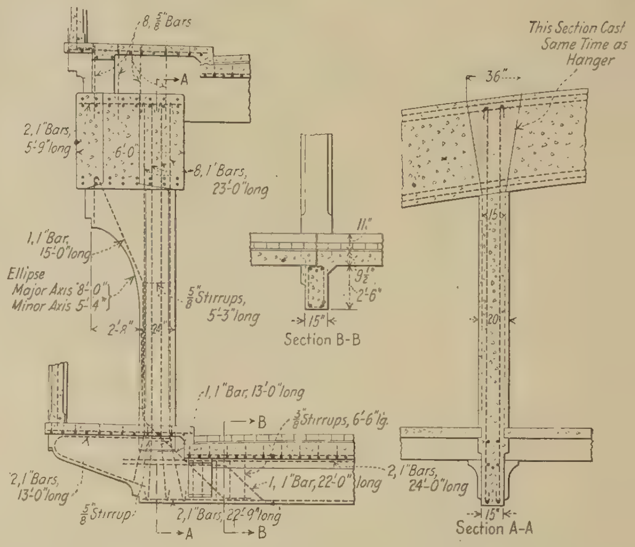
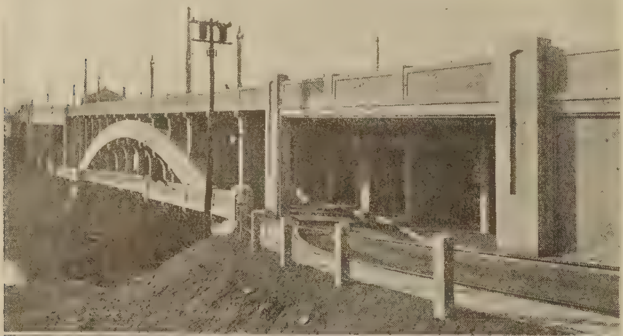


Fig. 4—Details of Hangers for the Lower Deck of the Watertown Bridge. Section A-A Shows the Method Used for Pouring Hangers to Prevent Cracks

To avoid cracks in the hangers supporting the lower roadway, due to the difference in the moduli of elasticity of the steel reinforcing and the concrete, an ingenious method was employed. When the arch ribs were poured, wedge-shaped openings were left at the points where the steel rods were hung to support the lower deck. After the lower deck was placed, the supports were removed, permitting these rods to be stressed with the entire dead load of the lower deck, thus taking the full deformation due to this dead load. Forms were then built around these hanger rods and the concrete poured, embedding them. Thus the only additional elongation of the steel which may be expected will come from live loads which will not be sufficient to cause any appreciable cracking in the concrete.

The Concrete Steel Engineering Co. of New York city were the designing and supervising engineers. The bridge was built by the Peckham Construction Co. of Buffalo.



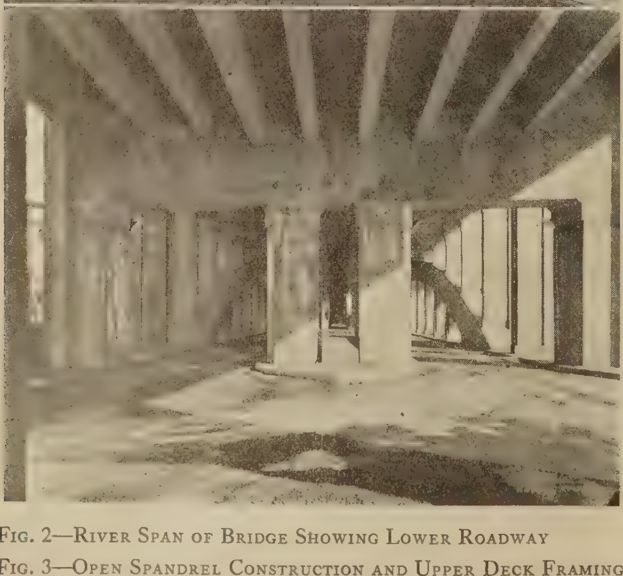


Fig. 2—River Span of Bridge Showing Lower Roadway

Fig. 3—Open Spandrel Construction and Upper Deck Framing

If you have used a new idea and it works, swap it for a hundred other, other fellows' ideas—through the pages of CONCRETE.

# Building Lake Placid Club at 50° Below Zero

Winter concreting jobs of magnitude can be carried on successfully and uninterruptedly when preparation is made thoroughly for minimum temperatures and the most rigorous conditions. The Turner Construction Co., New York, did a job last winter in the Adirondack Mountains, building the first three units of the new Lake Placid Club without the loss of a single day's work and carrying the schedule through on time by keeping an inside temperature of 40 to 58° above zero when the thermometer outside registered as low as 36° below zero. To accomplish this, the entire work was enclosed, the shed being built to extend 5 ft. outside the building lines to provide working space. The construction was of 2 x 6 uprights, 32 in. o. c., sheathed outside with ⅞-in. hemlock and box spruce, the cheapest material obtainable, and lined inside with tar paper—the spacing of the studs leaving 30 in. between the width of the paper. The roof was supported by wooden bents, using 3 x 4 posts approximately 10 ft. o. c. both ways. 150,000 B. F. of lumber was used for the enclosure. The bulk of this was salvaged and used on other work. The cost of this winter weather protection was about 10% of the contract price. This was considered more than justified by having the work taken care of in an off season and being ready as usual for the summer guests.

### From the Owner's Viewpoint

Lake Placid Club Members object to building operations during their summer vacation. They voted to build 130 rooms, each with bath, 6 stories, 44 x 210, with wings 30 x 40 and 20 x 30. The Club weather bureau sometimes gets a record of 50° below. As it was impossible to complete the building in time for its main use in summer unless work went on all winter and as the Club has for 29 years practiced the doctrine now preached on all sides as most desirable both for employers and labor, of distributing building over the entire year instead of concentrating on the always overcrowded spring, they built a wood shell that covered the 3 buildings completely, and kept it safe for concrete and comfortable for labor. Not an hour was lost all winter. They got better men at lower wages with no labor troubles or accidents and when others were just starting concrete work for this season the outer shell was torn down and the beautiful 6-story building was ready for the inside finish. Turner Construction Co. had the contract, laid out two schedules in the fall like a railroad time table and kept them more closely than many trains, for they were usually a few hours ahead of their program. The Club has only praise for Turner and for the new method.—Melvil Dewey, President, Lake Placid Club.

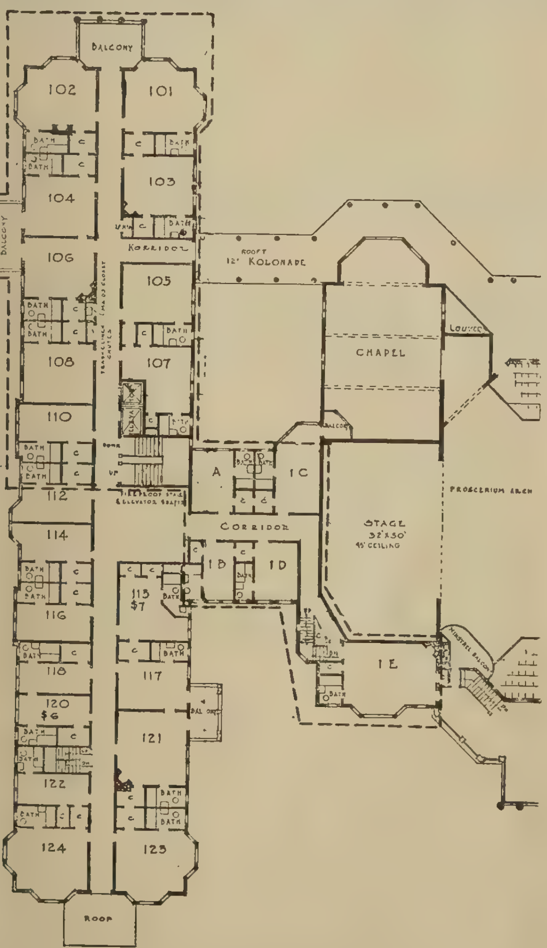


Fig. 1—The Broken Line Shows the Portions of Lake Placid Club Building Built Last Winter

The work included three connected units: Unit A, 107 x 44 ft. of five and six stories and basement; unit B, 37 x 34 ft., three stories and basement; and unit C, 17 x 33 ft., five stories and basement—all three being parts of the ultimate structure (See Fig. 1). The frame is reinforced concrete in bays 18 x 21 ft., with a 6-ft. corridor between, running the long way of the buildings A and B, faced with local rubble stone to the second floor and with rough brown brick above. The floors are interesting, especially so under the conditions of construction, being built unusually light. Built for 40 lbs. live load, they are 2 in. thick, reinforced for temperature stresses only; carried on reinforced concrete ribs 25¼ in. o. c. (See Fig. 2). The forms were made up in panels 25¼ in. wide from center line to center line of ribs. Over the slab is 2 in. of cinder concrete, with wood sleepers 12 in. o. c. flush with surface. The finish floor of maple was laid directly on the sleepers. Corridors are floored with cork tile on cinder concrete with a troweled finish. Partitions, except stair and elevator shaft, are of gypsum tile.

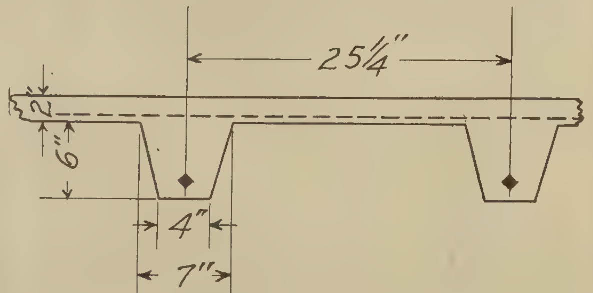
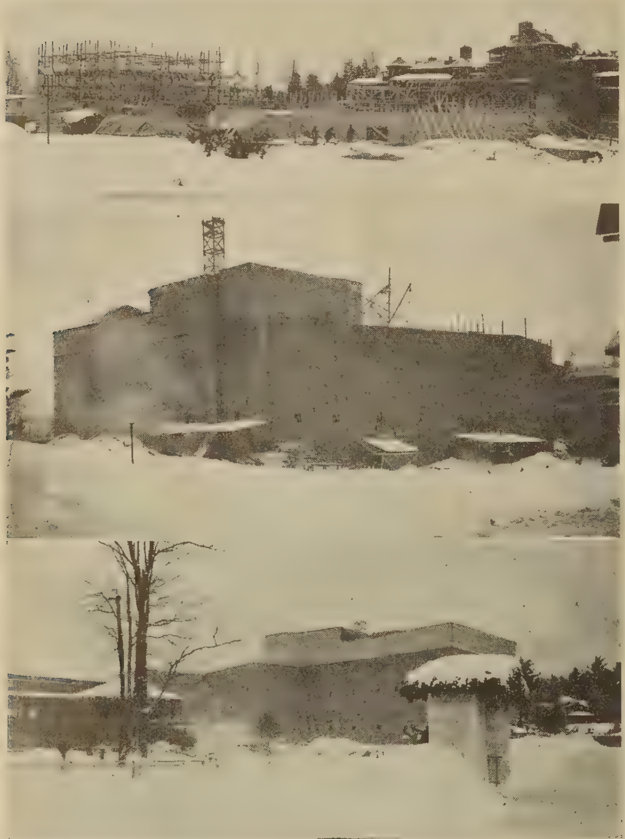


Fig. 2—Light Ribbed Floor Construction

After the shed was roofed over, it was heated by a B. F. Sturtevant Vento system with a capacity of 15,000 cu. ft. per min. at a temperature of 150°. Steam was supplied from the boilers serving the present buildings of the Lake Placid club. The coal consumption averaged 3½ tons a day. The heated air was distributed throughout the enclosure in wooden ducts. Artificial lighting was necessary inside the building after the outside walls were up.

The excavation for the foundations was begun November 23, 1922, by the owners of the property, the Lake Placid Club Co. Footings were started on November 29 and completed December 7. They were carried to a depth of 5½ ft. below the finished external grade. Their depth was dictated by frost penetration rather than by the class of material on which they were built. Measurements of the depth of frost penetration in the present spring showed 62 in.

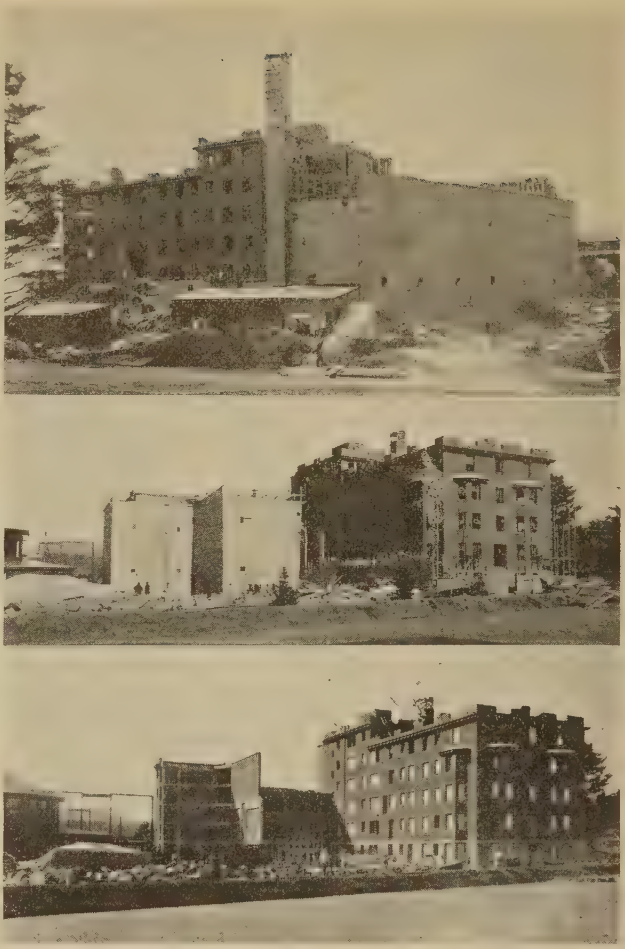
The work on the foundation walls and the first floor was carried on before the enclosure was completed, all exposed work being protected by canvas covers and heated with coke salamanders. The enclosure was completed to the fifth floor level and roofed over January 11, 1923. The heat was then turned into it and thereafter the men could work inside without heavy coats and gloves, the temperature averaging above 55°, except on some extremely cold days, with high winds. Only once did a thermometer register down to freezing inside the enclosure and then only along the ground below the level of the heating ducts.



Figs. 3, 4 and 5—Progress of Lake Placid Club Job—Top to Bottom—Dec. 21, 1922; Feb. 14, 1923; Feb. 14, 1923

At the time, the outside temperature was 32° below zero. Specimen temperatures on day of low temperature, were as follows: outside, 36 below zero, inside 40 to 58 above; outside 24 below, inside 42 to 46 above.

As much of the building material as could be obtained in the early winter was brought to the site while the roads were good and was stored outside the enclosure, under canvas covers. Some of the reinforcing steel was later stored in one of the clear spaces within the enclosure. Materials for the concrete were heated with steam since it was necessary to store them outside the shed.



Figs. 6, 7 and 8—Lake Placid Club Progress: April 26, 1923 April 26, 1923, and May 2, 1923

The progress schedule was followed so closely, except for the first and second floors, that the high roof was completed on schedule date, March 1. Progress was as follows:

1st floor concreting completed A—Jan. 12; B—Jan. 18; C—Jan. 23
2nd floor concreting completed A—Jan. 27; B—Jan. 28; C—Jan. 29
3rd floor concreting completed A—Feb. 2; B—Feb. 3; C—Feb. 5
4th floor concreting completed A—Feb. 8; B—Feb. 9; C—Feb. 10
5th floor concreting completed A—Feb. 14; B—Feb. 15; C—Feb. 16
6th floor concreting completed A—Mar. 21
Roof—March 1

The plastering was all done before the enclosure was removed, flood lighting being used to provide illumination. The building was substantially completed on May 15, and the enclosure was completely dismantled by April 28.

The work was done by the Turner Construction Co., New York. The architect was William G. Distin, Saranac Lake, N. Y.

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Competition, as everybody knows, is both good and bad. Everybody in the office, however, was much interested in the view of competition taken by one of the readers of Concrete. He sent in a remittance of $5.00 to renew his own subscription for one year and to pay for a year's subscription for "our new competitor Mr. ———." Competition is frequently good or bad because of the varying viewpoint between competitors. And viewpoint depends upon what? Sometimes it depends upon the kind of literature which two competitors read.

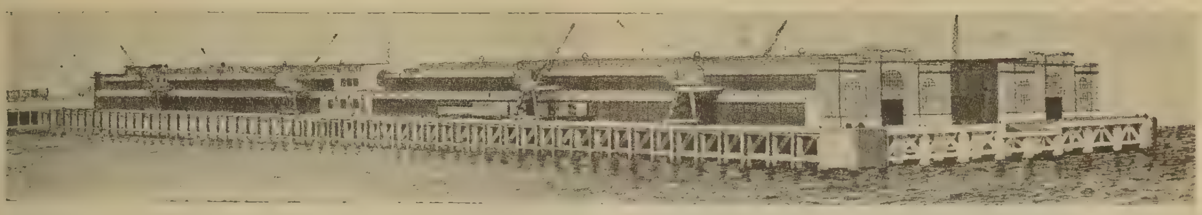


FIG. 1—BALLANTYNE PIER, VANCOUVER, BRITISH COLUMBIA

# Precast Units Form Substructure of Ballantyne Pier

The Ballantyne Pier, Vancouver, B. C., which is now nearing completion on the main harbor front between the first and second narrows on the south shore of Burrard Inlet, consists of a gravel fill with concrete deck on each side carried on two lines of timber and three lines of concrete piers with reinforced concrete sheds surmounting the decks. The pier is 1200 ft. long and 341 ft. wide. Interesting features in the construction of the pier include: precast cylindrical concrete piers; reinforced concrete sheet piling; timber pile piers capped with concrete; and precast trusses, fender blocks and walings.

Almost the entire substructure work below the deck level is reinforced concrete, and being precast, was allowed to become properly hardened before it was exposed to the sea water. Careful inspection of concrete was provided for with a view to obtaining more satisfactory results than could be obtained in placing the concrete in the water. The water in Vancouver harbor is much less saline than in the Pacific, due to the fact that it is diluted to a considerable extent by fresh water from rivers running into the inlet. The structure is not subjected to any severe freezing conditions.

In addition to the precast units of the pier, the main deck, girders, beams and upper fender beams are of reinforced concrete, cast in place and tied into the trusses and upper sections of the bearing columns. The concrete cylinders 7 ft. in diameter sunk to rock foundation support the structure. The pier, as a whole, gains an additional stability due to the sand and gravel fill in the center deposited before the main construction work was started. As all but the outer row of concrete piers were sunk through the gravel fill, this stability is in addition to the bracing by means of the lower and upper concrete fender beams and the cross bracing of the concrete trusses, the tops of which are tied into the main heavy concrete girders as a part of the deck.

The central gravel fill as shown in the accompanying cross section is 50 ft. wide at the top with the sides sloping 1 to 2½. This forms the heart of the pier and the shore quay embankment. The dredging and filling comprised a separate contract. The filling material was a heavy gravel obtained about 3 miles distant from the site of the pier. The gravel was brought down on dump scows and deposited directly from the scows until an elevation of about 3 ft. above low water was reached. The remaining portion of the fill was placed by clam shell. The fill parallel to the shore where the water was shallow was placed with the aid of a pump, a bulkhead being formed at the outer edge in the form of a bank thrown up with the clam shell.

Contract No. 1, for dredging and filling, was started in September 1920 and completed in November 1921. The work had progressed sufficiently so that contract No. 2, including the construction of reinforced concrete pier and transit shed, was started in March 1921.

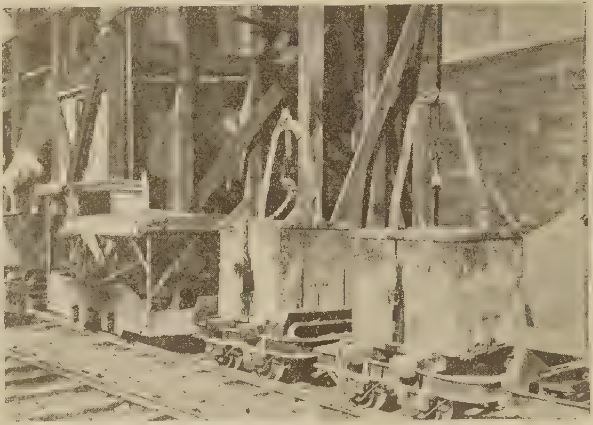
At the time work was started on contract No. 2 with the driving of timber false work for cylinder sinking, work was also started constructing the various precast parts. Owing to the fact that these units had to be seasoned for at least 60 days after pouring, a large amount of storage room was required. Land was found available for this purpose on the north side of the inlet. The yard comprised a level fill of about 30 acres about 2½ miles across the harbor and was well suited to the purpose. A pier at one corner of the yard extended to deep water and all gravel, sand and cement were delivered by water. Material was handled from the scows by means of a traveling timber gantry crane, which operated a 1-yd. clam shell bucket and delivered sand and gravel either direct to bins over the mixer or to storage on either side.

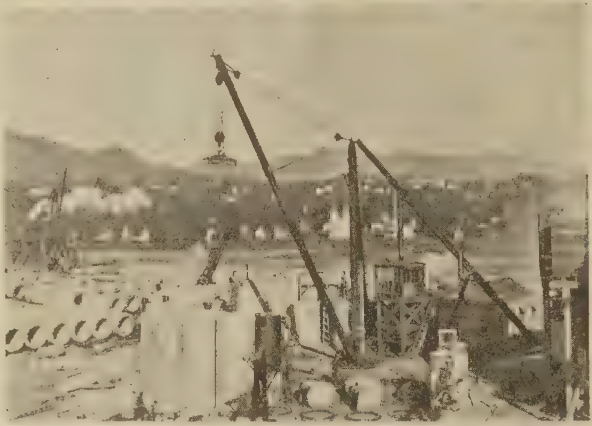
The cement was delivered from the cement boat to the pier in slings. The slings, handled by a gantry crane, were dropped in place through hatches in the roof of the cement shed direct to piles on the floor, level with the charging hopper of the mixer.

### MIXING PLANT

The layout of the mixing plant consisted of overhead bins which discharged into measuring boxes and thence into the hopper of a 1-yd. Smith mixer set so as to discharge into 1-yd. buckets on cars. The concrete was distributed in conical buckets by a gas locomotive, trains running on standard gauge tracks. A 20-ton stiff-leg derrick and a small air compressor for cylinder fabrication comprised a part of the plant, a 25-ton gantry crane was used for handling and loading, and a locomotive crane and clam shell derrick for supplying the bunkers of the mixer. The engine of the stiff-leg derrick was controlled from a lever house set high enough to give the operator full view of the work at all times. Concrete was delivered direct from the mixer to the cylinder forms by the derrick which was also used to set up and take down steel forms, reinforcing, steaming tarpaulins, as well as to handle the concrete cylinders and load them on cars for removal to the skidways.

The cylinders shown in the accompanying illustrations, of which there were about 30,000 lineal feet in the piers, containing about 25,000 cu. yds. of concrete, were cast in lengths varying from 4 ft. to 17½ ft. The units made in the yard were 7 ft. external and 5 ft. 6 in. internal diameter. The cylinders were reinforced





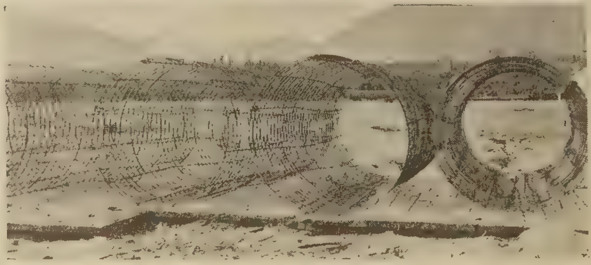
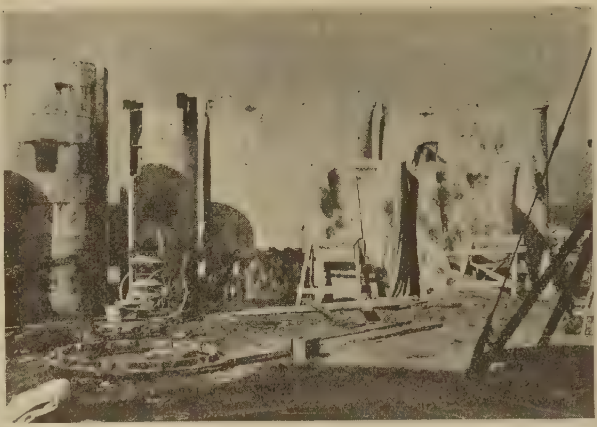


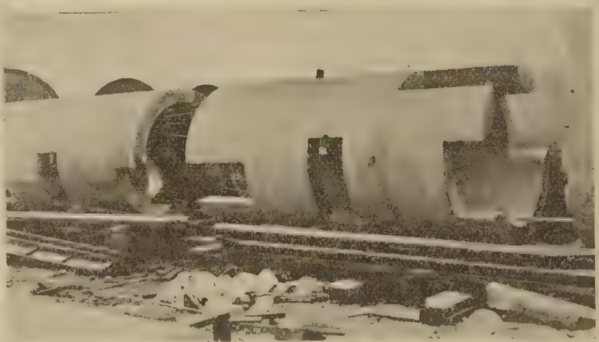
Fig. 2—Front View of Mixing Plant

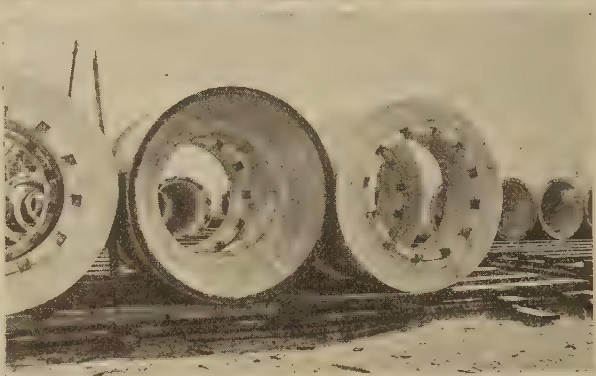
Fig. 3—Sealing Buckets Used for Sealing Cylinders

Fig. 4—Cylinder Casting Platforms

Fig. 5—Steel Cages for Cylinder Reinforcement







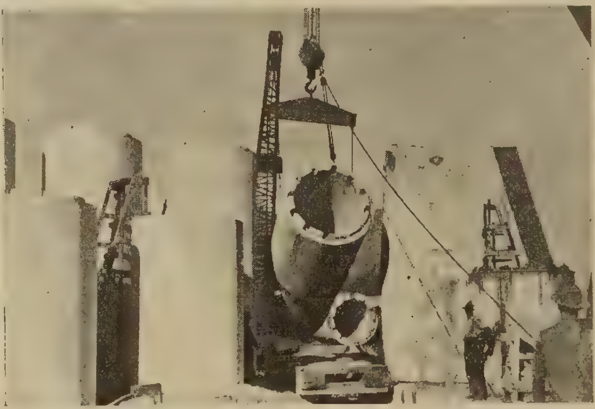


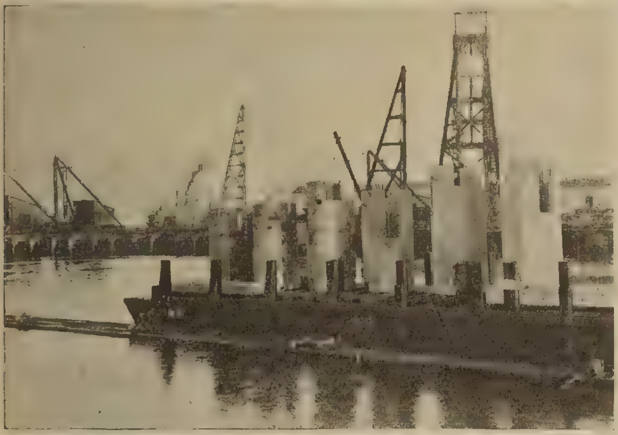
Fig. 6—Cylinders Covered with Canvas Being Steamed

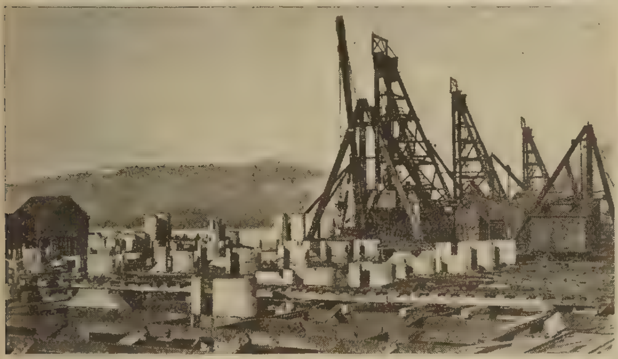
Fig. 7—Upper Section of Cylinders Showing Recesses for Ends of Trusses, Bearing Beams that Support Sheet Piling and Deck Beams and Girders

Fig. 8—View of Top and Bottom of a Cutting Edge 9 ft. Diameter Outside 5 ft. High

Fig. 9—Turning Section of Pipe and Loading onto Car for Removal to Storage Skidways

against handling stresses and by being provided with longitudinal rods projecting at each end and threaded, sections could be bolted together with nuts and clips thus furnishing continuous steel reinforcing from top to bottom of any desired length pier. The forms used on the cylinders were steel designed by the Lock-Joint





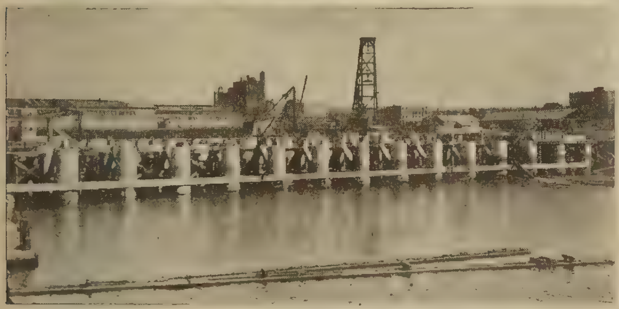


Fig. 10—Raising Pipe Off Base. Section Weighs 22 Tons
Fig. 11—Scow Load of Upper Sections of Cylinders
Fig. 12—Tops of Cylinders and Trusses Sticking up Through False Work. Ready for Deck Forms
Fig. 13—Shows Lower Fender Beams, Trusses, Upper Section of Columns in Place and Ready for Deck Forms

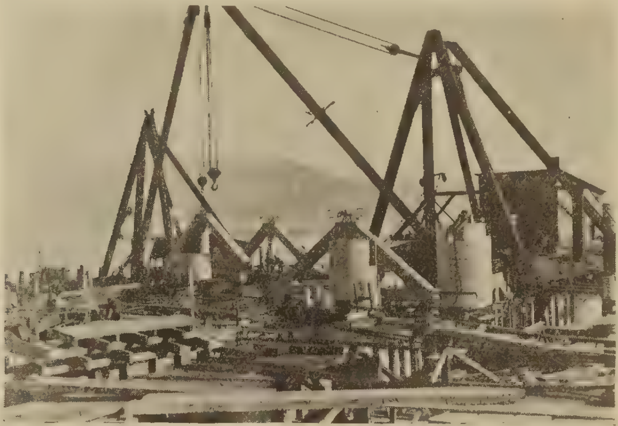
Pipe Co. A 1:1½:3 mix was used throughout and particular attention paid to the grading of the aggregate and the production of an impervious concrete.

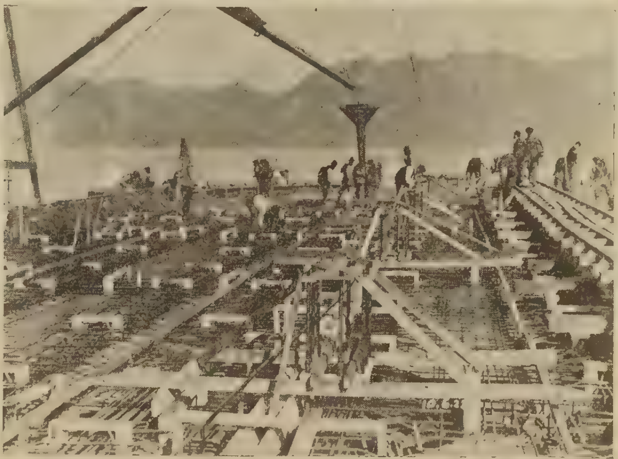
Tamping of the concrete was accomplished by two small air hammers which vibrated the outer steel shell of the form while pouring. This was found to produce a dense mass with a good skin.

Steam curing was resorted to in order to enable the forms to be removed and the sections handled as soon as possible after the concrete was poured. Steam was turned on through two jets, one on the inside and one on the outside of each cylinder, after the forms were filled and covered with a canvas tarpaulin. The steaming time varied with the outside temperature but rarely exceeding 10 hours for a cylinder.

On the next day after pouring, the forms were removed, and on the day following the cylinder sections were placed on a car operating on a depressed track so that the top of the car was level with the skidways and the cylinder section rolled off on to the skidways to cure. They were allowed to cure about three months before being used in the pier.

Two shifts were operated, the first shift starting in the morning, concreting the cylinders and completing operations by noon. Different precast units were poured by this crew in the afternoon and the second shift coming on at 1 o'clock and working until 9 p. m.





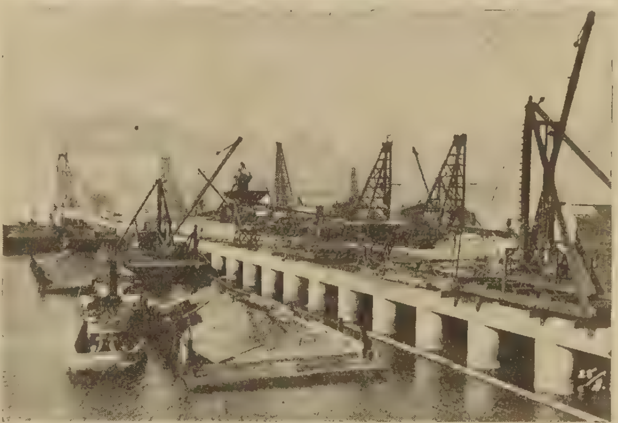
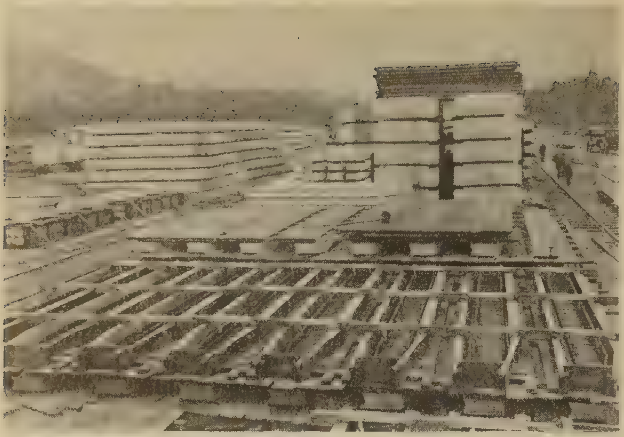
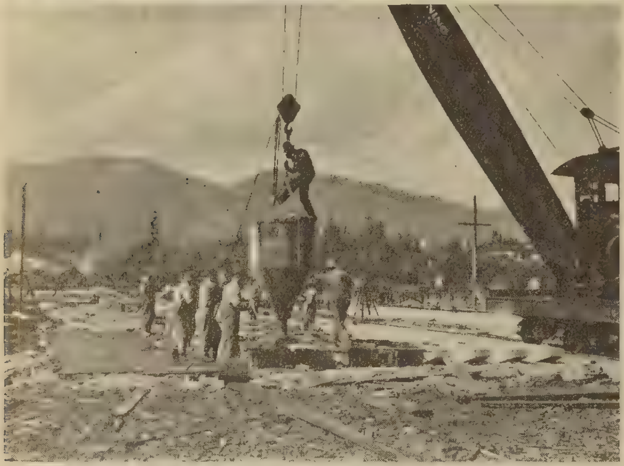


Fig. 14—Placing Trusses and Upper Sections of Cylinders
Fig. 15—Main Deck Reinforcement
Fig. 16—West Side of Pier Before Starting Sheds





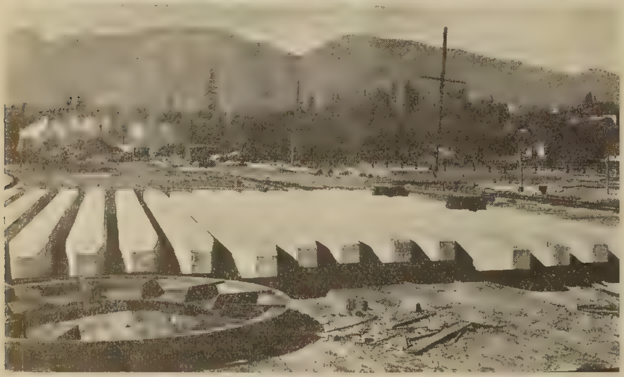


FIG. 17—SHEET PILE CASTING PLATFORM. FENDER BEAMS AT LEFT BACKGROUND, BEARING BEAMS AT RIGHT. REINFORCEMENT FOR SHEET PILES IN CENTER HELD BY HOOKS FROM STICKS LAID ACROSS THE FORMS

FIG. 18—SHEET PILE CASTING PLATFORM

FIG. 19—BEARING PILES 16 FT. X 16 FT.

stripped the cylinder forms, set up new forms, removed the cylinder sections to the yard and got things in readiness for the next day's pouring operation.

Special cylinder sections slotted to fit over the trusses and deck beams were made in a similar manner.

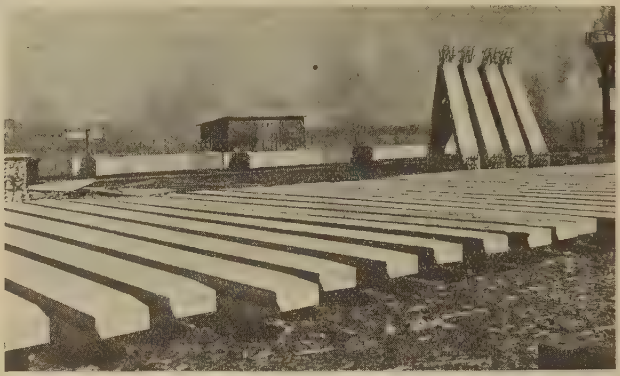
### SPECIAL PRECAST UNITS

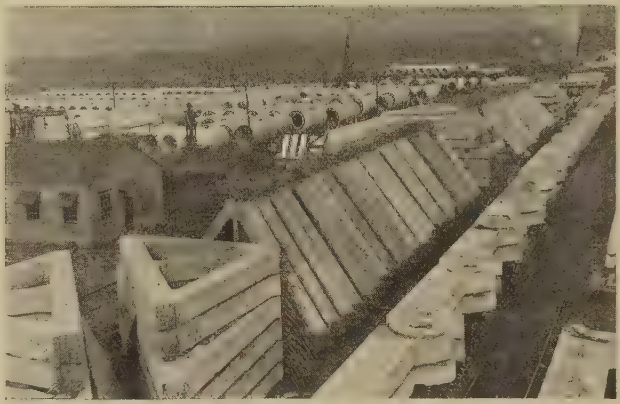
The special units were cast on platforms surfaced with sheet iron in sectional wood forms lined with steel and filled with concrete from the same bottom discharge buckets as used in pouring the cylinders. The trusses, fender blocks, struts, sheet piles and walings were hand-spaded and the exposed surface of the unit given a hard troweled finish. Steel reinforcing rods were left projecting beyond the concrete in the units where it was necessary in order to properly tie them together when placed in the completed structure.

The side forms of the special units were carefully removed the next day after pouring and the units left in place on the platform until it was safe to move them by means of locomotive crane and specially devised hooks and slings, when they were removed to the storage piles. The trusses were cast 4 high on prepared bases, a bottom wood form covered with steel being placed between each truss and the adjacent one in the pile.

The reinforcing steel cages and hoops for the cylinders were formed as shown in Fig. 5 in a small set of rolls. The bent rods were placed on forms to give them the proper circle and the lapped ends tied. The hoops thus formed were placed in a spacing frame for tying the straight rods in place. All steel, with the exception of the stirrups and hoops, was bent with a large motor driven power bender, stirrups being bent with a special machine devised on the job. The unit reinforcement was assembled on platforms or frames and afterwards placed in the forms by means of locomotive crane.

Steel chairs were not used in supporting the unit reinforcement in the forms, as it was thought that they





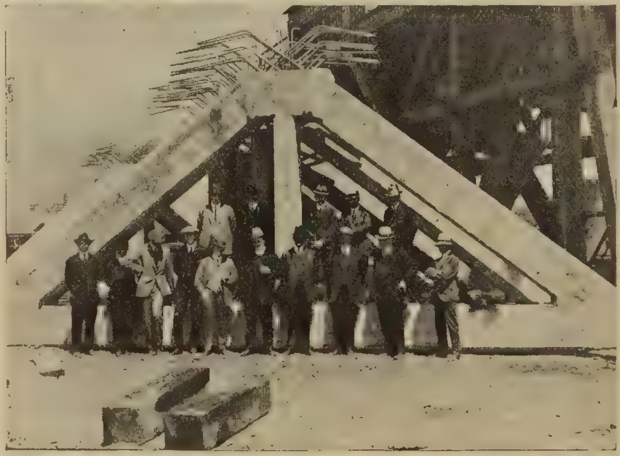


FIG. 20—SHEET PILES 12 IN. X 18 IN. X 35 FT. LONG

FIG. 21—VIEW IN CASTING STORAGE YARD SHOWING BEARING PILES SHEET PILES, FENDER BEAMS, TRUSSES AND CYLINDERS

FIG. 22—ONE OF MAIN TRUSSES. WEIGHT 26 TONS

might rust in time and cause corrosion of the reinforcing later. A system of temporary support was used and all of the reinforcement on the job hung up on hooks until the forms were filled, and then the hooks were removed.

The reinforced concrete sheet piling and load bearing piles were cast on a horizontal platform as shown in Figs. 17 and 18, the reinforcing being supported on temporary hooks from above which were also removed after the concrete was poured.

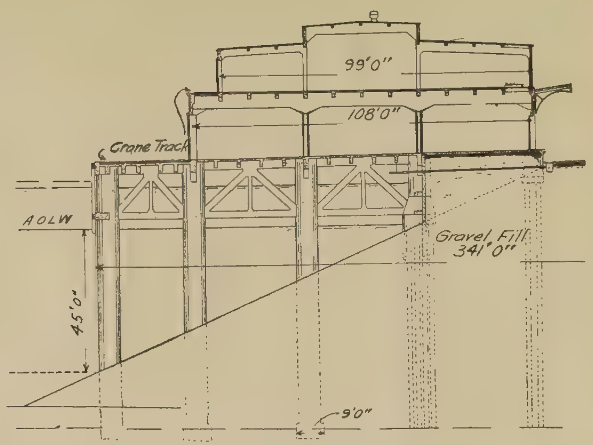


Fig. 23—Cross Section Through Half of Pier at Outer Berth

### Sinking Piers

The sinking of the cylinder piers, of which there were 436 consisting of precast sections bolted together, was accomplished with the use of specially constructed cylinder drivers on timber falsework. The sections of the cylinders were taken off scows by floating derricks and built up in the lead of the driver as the cylinder was forced down through the material to bed rock. The drivers were capable of handling sections of cylinder weighing up to 85 tons.

As the cylinder sank, the material was dredged out from the inside with orange-peel buckets. As the cutting edge reached a point below the fill, it was found necessary to use additional weight to overcome the skin friction and 6-ton cast iron rings were used for this weight. In some cases, as high as 240 tons additional weight was necessary to sink the cylinder. High pressure water jets were used where the material encountered by the cutting edge was too hard to dig with the bucket. Boulders were lifted out with the hoist after holes had been drilled by a diver and pins with shackles inserted, the holes being drilled at a small inclination to each other so as to provide the necessary grip.

Two kinds of cutting edge sections were used, the type in each case depending upon the loading and the nature of the foundation to which the cylinders were to be sunk. One of these cutting edges, 9 ft. in diameter and 5 ft. high, is shown in Fig. 8. The other type was 7 ft. in diameter and 17 ft. 6 in. long. As the cylinder drivers were the only rigs able to set the cylinders, after a cylinder had been set and sunk a considerable distance, the driver was moved off and sinking operations were completed by a skid derrick. This provided for a most efficient use of the cylinder drivers.

The cylinders were built up in the lead of the driver by the derrick boat, placing a length of cylinder on top of the cutting edge section so that the joint could be waterproofed and the two sections bolted tightly together. The operation was continued with section after section until as the sinking process continued, the top of the cylinder was almost to high water line. When the lengths were all in place an added 15-ft. length was placed without the joint being waterproofed, in order to give increased weight to aid in sinking and to have the material from the orange-peel bucket discharged free from the cylinder.

When the cylinder was finally resting upon a suitable foundation, the bottom inside of the cylinder was cleaned out by a diver and a seal of rich concrete deposited by means of underwater concrete buckets, generally 6 or 7 cu. yds. of concrete being placed in the bottom of each cylinder. After this concrete seal had set for several days, a wooden stave cofferdam was placed on top of the cylinder to bring it above high water after the weight section was unbolted and removed. The cylinder was then pumped out dry, cleaned and inspected and finally filled with concrete, completing the cylinder up to 4 ft. above low water. The mix used in filling the cylinder was supplied by a floating mixing plant and was proportioned 1:3:6, with a 1:4:8 mix to the ground level in the case of the deeper cylinders.

After the wooden stave cofferdams were removed and the top filled with concrete, the next step was the setting of the trusses in their proper location on top of the filled cylinders and fender beams. The timber piling was driven and capped for the two inside rows of piers, keeping pace with the sinking of the cylinders. The cap on the 12-pile pier was poured by means of a tremie pipe and the cap brought up to the same level as the cylinder piers. With the cylinder and pile pier foundation complete, the setting of the substructure of the main deck was begun. This work had to be done at low tide.

With the trusses, fender blocks and top cylinder lengths grouted into their correct position on top of the piers, and the walings for the sheet piles placed in their slots, forms were fastened around the cylinders at the points where the units entered and the projecting steel reinforcement thoroughly cleaned. Before filling the cylinders with concrete to the level of the deck girder slots, reinforcing was added in the form of steel rods and old rails to increase the bond between the fender block and the outside row of piers. These rods were extended into the cope beams. A 30-ton derrick moving on the falsework and also a floating derrick were used in setting this portion of the work, many of the units of which weighed as much as 25 tons each.

The sheet piling was driven by a single acting No. 2 steam hammer operating at the end of the derrick boom. The piles being tongued and grooved set together well when driven.

### Construction of Main Deck

The main deck was poured largely in 40-ft lengths so the planes at the end of a day's work were arranged at the center of the bays. A covering of at least 2½ in. of concrete was provided below the steel to minimize the action of sea water on the steel. Operations were carried on simultaneously from a floating plant with a chute and another land plant with side dump cars hauled over a narrow gauge track by gasoline locomotive. A 1:1½:3 mix was used throughout the main deck section.

Fresh water run aggregate and sand were used in the concrete and fresh water was used entirely for mixing. The sand and gravel were all fresh water washed and carefully screened and graded, the largest size gravel passing through a 1¼-in. ring.

### Construction of Sheds

The forms for the main girders for the first floor of the sheds now under construction are carried on steel trusses and the floor and roof systems are made up with steel frame sections of convenient size for handling. These forms have been designed with considerable care in order to provide for speedy erection and stripping and it is anticipated that one set will be sufficient for 4 sheds. Test cubes taken during each pour are tested to determine the correct time for stripping the forms, the concrete being of a 1:2:4 mix. The main columns are made with a 1:1½:3 concrete and the main girders have been specially strengthened with a view to probable installation of grain conveyors. Towers and chutes are used for placing this part of the concrete.

The contractors for contract No. 1 including the dredging and placing of the gravel fill were Messrs. Grant and McDonald. Contract for construction of the pier and sheds is being carried out by the Northern Construction Co. Ltd. and J. W. Stewart. The design of A. D. Swan, consulting engineer, Montreal, is being followed and William Smaill is chief engineer of the Northern Construction Co. It is estimated that the pier will be open to traffic by the end of 1923 and that the ultimate cost of the pier and equipment will be $6,000,000.

# Permanent Subdivision Improvements

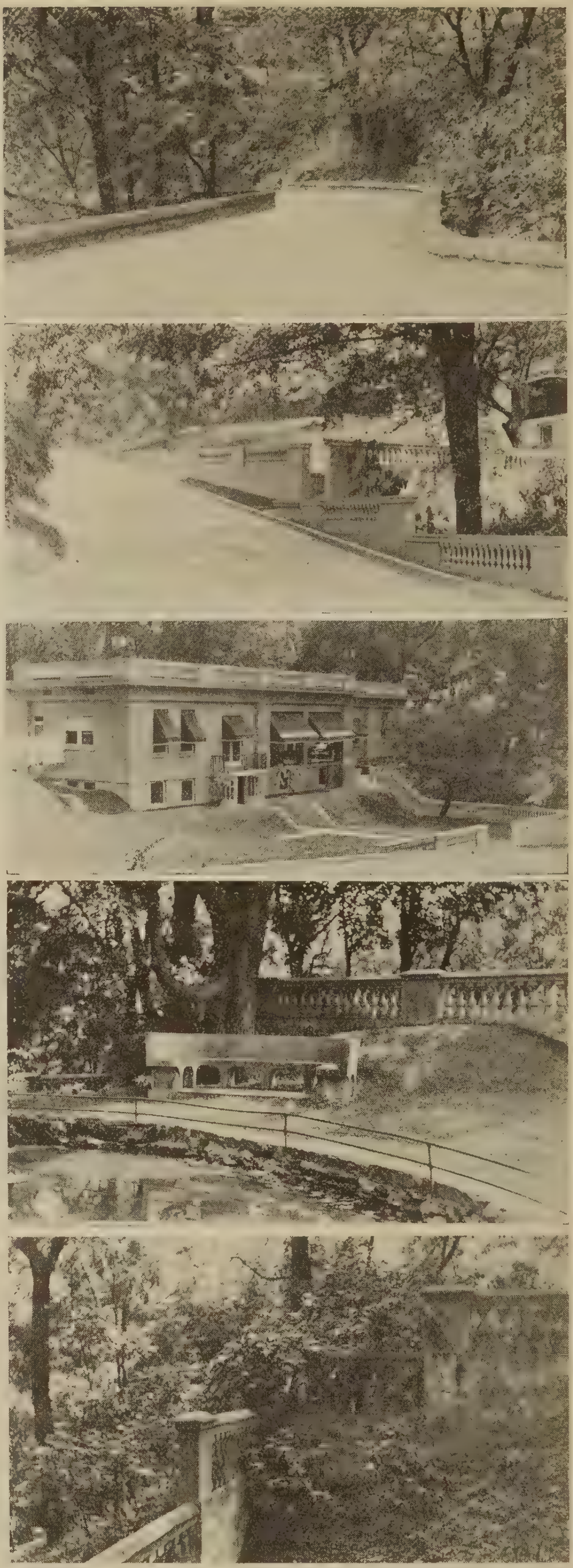
The desire to make improvements of a high quality in keeping with the class of customers to whom he wished to appeal, led John A. Howard to adopt concrete as the material for all general construction work in subdividing the Howard Estate, which lay along the National Pike, near Wheeling, W. Va.

A feature of the subdivision attractive to clients but presenting difficulties in layout and construction, is the hilly topography which calls for contour streets involving frequent turns and steep grades. After careful consideration, concrete was adopted as the paving material because of its adaptability in fulfilling the conditions imposed. About one and one-half miles of 8-in. pavement 16 ft. wide has been laid for the direct accommodation of local motor traffic, integral curbs being included at sharp curves and other places where safety rendered the practice advisable.

To carry out the woodland motif in the landscaping, concrete rustic culverts and bridges were built and concrete garden furniture placed in the numerous small parks. As an indication of the scheme he had in mind, and as an inspiration to future builders, Mr. Howard erected at advantageous points a number of houses of which the white cement stuccoed Italian villa shown in the illustration is an example.

Further use of concrete will be made in extending the original plan. A corps of skilled workmen is maintained, working on the day labor plan, which allows wide latitude in the sequence of undertakings prosecuted. When weather conditions prevent outdoor operations, the workmen engage in making various ornamental units for garden furniture. Some of this furniture, however, is of monolithic concrete cast in place.

Plans for this year call for the construction of an outdoor swimming pool of concrete, with completion of the paving, and a further increase of equipment for the small parks. The liberal use of concrete has made the Howard subdivision exceptionally attractive, and the surest indication of its success from a financial standpoint is the decision to extend it greatly for the coming year.



Wheeling, W. Va., Subdivision Improvements

If you have a good idea in your work, pass it on for "the other fellow."

# How to Patch and Point Up

Courtesy of *Contractors' Atlas.*

The patching or "pointing-up" of concrete work is something that is avoided whenever possible, but in spite of the greatest care it is sometimes necessary. When the forms are stripped a few air-pockets may be revealed; or a bad spot in a concrete floor may need repairing; or perhaps an alteration requires cutting and patching of the concrete.

What are the most important points to be observed in doing the patching? First, care in preparing the old concrete; second, proper manipulation of the patching material; and third, proper and thorough curing of the new concrete.

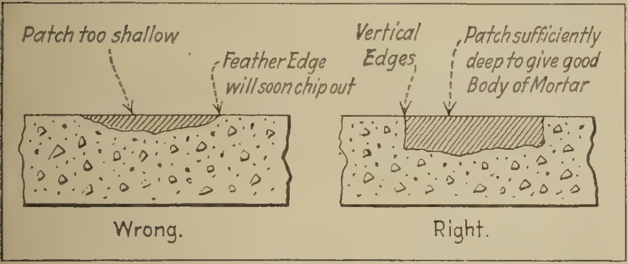

Patch too shallow
Feather Edge will soon chip out
Vertical Edges
Patch sufficiently deep to give good Body of Mortar
Wrong.
Right.

Fig. 1—Right and Wrong Method for Patching a Small Shallow Hole in a Concrete Wall or Floor. Often Only a Short Time Can Elapse Between Patching a Floor and Using the Floor. In Such Cases Probably Calcium Chloride in the Mixing Water Would Help in Securing Early Strength for the New Concrete

Small shallow holes or cavities should be cut out enough to give space for a sufficient body of new concrete and mortar. Fig. 1 indicates the proper cutting out to accomplish this. All loose material should be chiseled out and removed and the old concrete left clean and rough. Washing the edges with a 1:5 muriatic acid solution is even advocated by some to give a surface that will afford the very best bond for the new material. (If acid is used the surface should be thoroughly washed of all traces of it.—Editor).

Just before placing the new mortar or concrete the old concrete is wet down and the bonding surface painted with a neat cement grout. The new material is then immediately placed before the grout has a chance to dry. Probably one of the commonest errors in patching is to mix the new concrete or mortar much too wet and really pouring or slushing it into place. This may result in a pulling away from the old concrete, when the excess water dries out.

It is preferable to mix the mortar to the consistence of damp moulding sand and caulk and ram this into place. After hard tamping and pounding moisture should just show on the surface. Avoid too rich a mixture for the patching material. If possible use the same mixture as that of the old concrete. Of course, for a small patch it is not feasible to employ concrete, but the mortar should be as lean as compatible with workability and density. As soon as the patch is finished, it should be allowed to absorb as much water as it will from a gentle spraying or covering with dripping wet cloths.

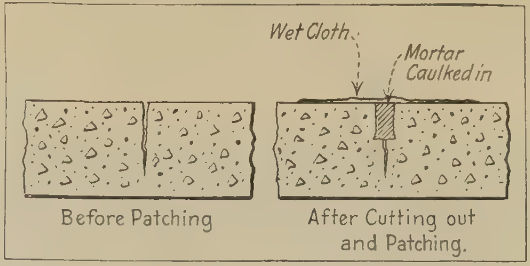


Fig. 2—Repairing a Fair-Sized Crack, Say, Over $\frac{1}{16}$ In. Wide. For Very Fine Cracks it May Be Possible to Flush Out the Crack and Fill with a Cement Grout. One Concrete Worker Reports Excellent Results for Filling Fine Cracks in Horizontal Surfaces by First Washing Out the Crack and Filling It with Water, and Then Sifting Dry Cement into the Water Until the Crack is Filled

In most patching and pointing-up the volume of new material is relatively small, hence will dry out very rapidly unless protected and kept wet until it has opportunity to harden well. It is not unusual to see a small patch of a few square inches area exposed to the hot sun without any protection. Naturally it dries out in a few hours, fails to gain any strength, and the workman wonders why the patching is not more successful. *Give the patch plenty of water!* The steps in making a good patch might be summarized as follows:

1. Clean out and prepare cavity.
2. Wet and grout old surfaces.
3. Mix mortar or concrete as dry as can be handled.
4. Caulk, ram or tamp new material into place.
5. Allow patch to absorb as much water as possible.
6. Prevent drying-out until well hardened.

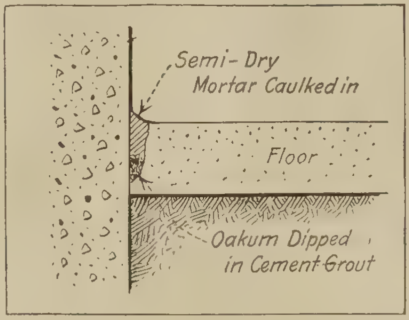
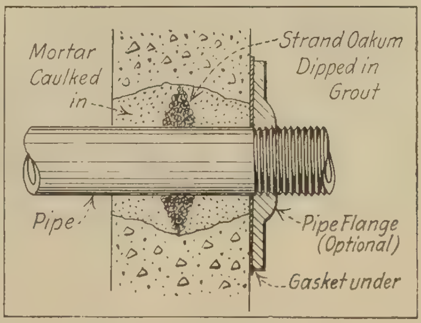


Fig. 3—Making a Water-tight Joint at the Junction of Cellar Floor and Wall

Fig. 4—Running a Pipe Through an Old Concrete Wall



If Pipe is a Steam or Hot Water Pipe it Should be Placed in a Sleeve or Some other Arrangement Made to Allow for Expansion and Contraction of the Pipe without Cracking the Concrete

# "Peg"

By Howard K. Bell
Civil Engineer, Lexington, Ky.

Peg and One of His Jobs

In the articles we read describing the details and methods of construction of engineering structures, we usually see mention made of the engineers and high officials connected with the enterprises, but very seldom is anything said of the individual, rugged men who do the work and upon whom the success of our work most largely depends. Since the passing of one of these men, who was more largely connected with my own work than any other, I feel that I must give a brief account of him as I knew him during the last twelve years.

E. E. Southworth, or "Peg" as he was familiarly known to his fellow workers, was killed by a live wire last January as he was putting the finishing touches on a concrete floor behind the switch board of the power plant at Springfield, Ky. He had been there since the previous June and had done all the form work and finishing of the concrete in their new fireproof water, light, and ice plant and would have left that day to go to Logan, W. Va. to work on a filter plant for the writer.

He was born on a farm near Georgetown, Ky., and was 54 years old at the time of his death. About thirty years ago, he lost a leg while working as brakeman on a Cincinnati Southern freight train. From that time he used a peg leg of his own manufacture, hence the nickname he carried wherever he worked. For about eighteen years after his accident he, being of an adventurous disposition, still followed railroading alternating it with a little steamboating and farming.

In the spring of 1911, after a few days absence from the city, I walked into my office and contracting yard in Lexington and found a man with a peg leg unloading materials. I said something to the office force about there being enough able bodied men to do the work without employing cripples. I was told to watch him and I would soon see that he did more work than any of the other men. It was then that I discovered "Peg" and I think it must have been during the same season that he really discovered himself, as it was not long until he learned the art of finishing and building forms and was, in spite of his handicap, the highest paid workman on the job.

Although he worked at times for others, he was most largely identified with my own work and was always found dependable and loyal to his employer and his work. In build, he was of the tall slender type, all bone and sinew and was seemingly untiring at his work. No hour was too late if the cement needed his trowel for the final touches. He had no fear of heights, climbing ladders, and working in places that but few with two good legs would go. Always cheerful of disposition, he livened the job with his jokes and was always popular with his fellow workers and a wonder to the people wherever he did work. He sometimes used strong language when out of patience with his helpers, and smoked an awful strong pipe; but then we know it is a rough life.

Here is a picture of "Peg" as he appeared on the work and also one of a bridge on which he did nearly all of the excavation, form work, steel placing and finishing when the war took away all the other skilled workmen.

# Mixing Portland and Roman Cements

Sometimes a contractor, more often a concrete products manufacturer gets certain results and attributes them, good or bad, as the case may be, to the wrong thing. Some time ago we were asked about the use of "a mixture of Portland and Roman cements to produce a non-shrinkable concrete." We put the question up to P. H. Bates and J. C. Pearson of the Bureau of Standards. Mr. Pearson writes: "After discussing the matter with Mr. Bates we are of the opinion that there is no reason from our present knowledge to believe that the mixture of one part Roman cement and two parts White Portland cement together with three parts of sand should produce a non-shrinkable mixture. The fact that some operator is getting good results with such a mixture does not necessarily indicate that the mixture itself is responsible for the results. From our experience and knowledge of the manufacture of cement products, the application of stucco, etc., we are inclined to believe that the 'knowing how' is likely to be responsible for the results obtained rather than certain doubtful properties of the materials used.

# Standard Bridge Practice of the Michigan State Highway Department

By C. A. Melick
State Highway Department Bridge Engineer
Lansing, Michigan

The Conclusion of a Paper Read at the Highway Engineering Conference, University of Michigan, Ann Arbor, February 15, 1923. The First Part of the Paper appeared in Concrete, July, 1923.

It has been felt for some time, that in designing our girders we should pay more attention to aesthetic treatment and, without going into ostentatious adornment, this can probably best be done by the use of end pilasters, deep belt courses and heavily shadowed panels.

### Width of Roadway

The next consideration in preparation of our standards was the roadway widths for which it was advisable to prepare standards. There is still considerable call for 18-ft. roadways (inside of curbs) on township and minor roads and since costs must always be borne uppermost in mind on such roads, it was necessary to provide 18-ft. roadways for such uses. The Department has adopted a tentative standard on its busy Trunk Line Roads of 24-ft. roadways in spans up to and including 40-ft. and 22-ft. roadways in the larger spans, up to and including 90-ft. and 18-to 20-ft. roadways in greater spans. In general, it seems desirable to have a width inside of curbs of at least 2 ft. more than the width of the pavement. The narrowing of roadways for longer spans is partly due to the fact that the dead weight per foot of span increases rapidly as the span increases and thus causes a sharp increase in cost. This narrowing of roadways with longer spans is further explained by the assumption that a long span means a large structure, the massiveness of which appeals to an approaching driver as an *obstacle*, thus calling for decreased speed in which case a narrow road is not so objectionable. How long this reasoning will hold good is problematical. On Trunk Line roads with lighter traffic and on the majority of County roads, the 20-ft. roadway will probably continue as a standard for some years. On heavy traffic Federal Aid roads the Bureau of Public Roads is uniformly insisting on 24-ft. roadways. Thus it will be seen that we must provide standards in roadways of 18, 20, 22 and 24 ft. Our concrete girders actually provide an additional clear width of 1 ft. between end pilasters and 1 ft. 9 in. between girders over and above the clear widths inside curbs as noted above.

Fig. 10—View Showing Manner of Anchoring Sidewalks to Bridge Where Previous Provision Was Made for Fastening Steel

It now becomes necessary to decide the span limits, in which our concrete girders can safely and economically be built. After deciding on a maximum depth from crown of roadway to low concrete of 3 ft. as noted above, it is apparent that the maximum permissible span will depend upon the maximum permissible height to which the girder may be extended above the crown of roadway. In addition to this, must be taken into consideration the matter of obstruction of view from the roadway. We have adopted a height of 4 ft. above crown of roadway (3 ft. 5 in. above sidewalks or curb elevation) as the standard height of all short span girders (including 45-ft. spans) with straight horizontal top chords. For the longer spans it is necessary to increase this at the center of span, tapering this depth off to the standard depth in a curve closely resembling the "Probability Curve" of the mathematical family. We find that when our spans reach 60 ft. that this depth at mid span has increased to 5 ft. 6 in. Our spans then jump to 75 ft. and then to 90 ft., the corresponding depths being 8 ft. 6 in. and 11 ft. 6 in., respectively, for such cases. When the heights are so great as given for 75- and 90-ft. spans, it becomes necessary to provide window open-

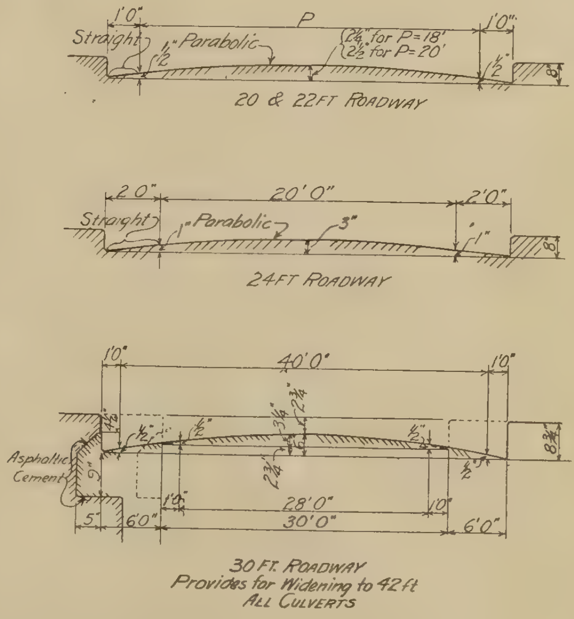


Fig. 11—Details of Cross Sections of Roadways

ings to avoid the general "tunnel" effect which would otherwise result; and these openings have been provided with the sills of the standard girder height of 4 ft. and 5 window openings per girder provided with a size of opening of about 4 ft. x 2 ft. 5 in. height at the central window. These window openings occur in merely the central portion of the span where the shears are relatively light and easily taken care of by two 1-in. U stirrups between the window openings. It was decided that a maximum width of girder of 2 ft. 6 in. should not be exceeded, due to the massive appearance of a wider rib.

It was further felt that a height of 11 ft. above the roadway was about the maximum desirable for a compression chord without lateral support in a span of 90 ft. This gives a slenderness ratio for the top chord of 125, assuming the entire chord in compression and acting as a strut, or probably not over 60 for the portion which might be said to be really nonsupported. For a 90-ft. girder with a 20-ft. roadway, the superstructure would contain 255 cu. yds. of concrete which at an average price of $32.00 would cost $8,180. A 90x20-ft. steel structure of our modern type would weigh, including shoes, etc., 120,000 lbs. This steel would cost us 6½c per lb. erected or a total of $8,200. To this we must add a concrete floor which would contain 40 cu. yds. and would cost us $40 per cu. yd., let as a separate contract, or a total for the floor of $1,600, making a total charge for the steel as against the concrete structure of $9,800 against $8,180. In addition, the abutments for the concrete girders are much cheaper since the bridge seats extend to a depth of 8 ft., and above this elevation, the abutment is merely a 12 in. curtain-wall joining the two girders together with very thin sloping parapet wings outside of the girders. The economy of the concrete spans up to and including 90 ft. is therefore unquestioned.

In order to care for the flexure and shear at and near the supports, it is necessary that curved brackets be used and a comparatively large depth to bridge seat as noted above. Even so, it is found that the maximum stresses occur at the haunch on the top chord at about the point where the top chord stresses have their greatest inclination from the horizontal. We have to use about ¾% of compression steel at this point and even so find our stresses figure about 25% higher here than at mid-span. We have made tests on three of these 90-ft. girders to date and find that they have ample margin of strength and possess great rigidity. The weight of a 90-ft. girder with 20-ft. roadway is approximately 516 tons. At Riverdale on our bridge file number 291402, we placed an extraneous load of 220 tons composed of sand fill, uniformly distributed over the span, and found that after knocking out all wedges and leaving the structure free, at an age of 60 days, the girder deflected at mid-span an amount of 0.09 in., under this extraneous load. The design capacity of one of these spans is 100 lbs. per sq. ft. or 90 tons total or a gross design load of 606 tons. The gross load with maximum test load on was 936 tons. For this gross load, the deflection at mid span figures about 0.69 in. of which the 220-ton load should cause 220/736 x 0.69 or 0.207 in. It will be noted that only about one-half of this value was obtained. These results were verified by similar tests on a 90-ft. span at Hamburg, our file number 470701. We find that when falsework wedges are removed that the deflection of the structure at mid-span for a 90-ft. girder is consistently about 0.075 in., whereas by the ratios above this should have been 516/736 x 0.69 or 0.484 in. Very evidently the major portion of the dead load deflection was absorbed by falsework subsequent to casting and prior to our tests. Our strain gage readings show that the stresses in these girders are not distributed just as we figured the girders. For example, it seems likely that the floor slab is acting with the girder in longitudinal tension, thus pulling down the neutral axis; and it further seems that the concrete in the bottom flanges of the girders is taking tension. Our calculations show that on these assumptions and under design loading of 90 tons there would result a tension at the bottom fiber at mid-span of 297 x 606/516 or 348 lbs. per sq. in. and a compression at the center of top chord of 563 x 606/516 or 660 lbs. per sq. in. The latter unit is almost exactly the amount used in our design figures (650). We found by strain gage readings that our stresses at the haunch checked uniformly higher than those at mid-span as would be expected from the design and as heretofore noted.

Fig. 12—Finished Walk in Place, with Precast Spindle Railing

### Unit Stresses Used

We have often been asked why we do not use a smaller unit stress for our steel, say 14,000 lbs. instead of 16,000 lbs., so as to provide a margin for increased future loadings due to the fact that as the concrete ages its strength increases, while the strength of the steel remains constant, and our design must necessarily be based on a 28-day strength. It may be noted that the increase in strength of the concrete is partially offset by the increase of its modulus value and also in girders such as these a 50% increase in live load would affect our stresses only 7.4%. It does not seem advisable for structures with such great dead load ratios to invest in the additional steel. We had occasion to try out one of the 90-ft. girders for impact. Two 5-ton trucks with a gross load of about 11 tons each and with rear axle loads of about 8 tons on hard rubber tires badly worn were placed on the Riverdale bridge, facing in opposite directions with the rear axles of each truck opposite mid-span and with one truck as close to the South Girder curb as possible and with the other truck as close to the first truck as possible. A 2-in. x 6-in. (full dimension) oak block was placed under the rear wheel next to the curb and this truck then moved backward and forward over the block. The strain gage dial was held at both top and bottom gage points at mid-span and steadily observed during this movement. Hardly a tremor of the Ames dial was noted, the maximum movement during the entire procedure being between ¼ and ½ of the smallest division, amounting to a unit stress of from 7 to 15 lbs. per sq. in. These loadings were so relatively small, however, that the impact percentage can not well be determined. We would conclude however, that the impact in this case was probably

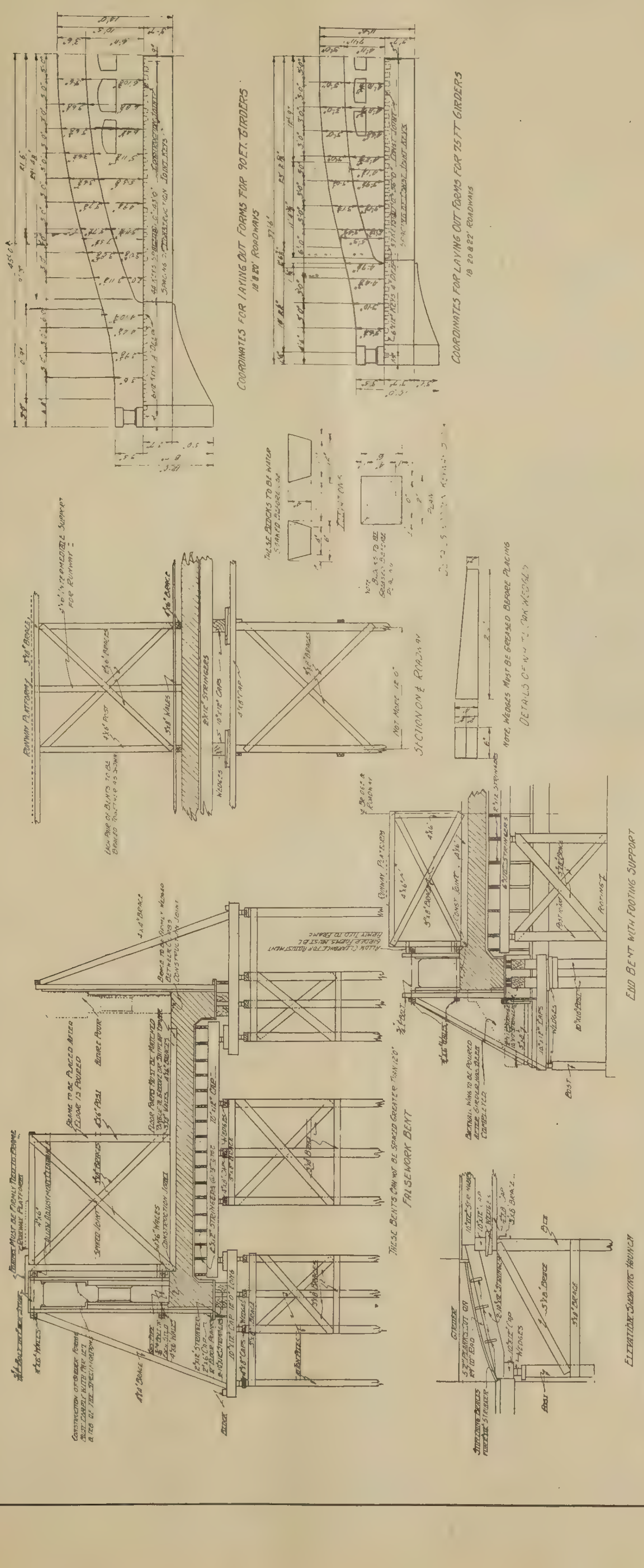

Coordinates for Laying Out Forms for 90 Ft. Girders
18 & 20 Roadways
Coordinates for Laying Out Forms for 75 Ft Girders
18 20 & 22 Roadways
Falsework Bent
These Bents Cannot Be Spaced Greater Than 12'0"
Section on ℄ Roadway
Details of Wood Wedges
Note, Wedges Must Be Greased Before Placing
End Bent with Footing Support
Elevation Showing Haunch
Runway Platform

Fig. 13—Details of Forms and Coordinates for Laying Out Forms for 75-Ft. Girder, with 18-Ft., 20-Ft., and 22-Ft. Roadways

from 15% to 30% of the static stress. A slight tremor could be felt through the structure although this was not objectionably noticeable.

We are now getting out plans for concrete spans of 100, 110, and 120 ft. but we are providing 3 bays of top struts at the central portion of the span, since it is evident that compression chords of this length should have intermediate lateral support. It is apparent of course that the sudden jump from the 90-ft. span with no overhead bracing to a 120-ft. span with overhead bracing and a 16-ft. clearance height will be somewhat uneconomical. For a 100-ft. span with 20-ft. roadway, we estimate that the superstructure will contain about 370 cu. yds. which at $32.00 per cu. yd. would cost $11,800. An equivalent steel span would weigh 146,000 lbs. and at 6½c erected would cost $9,500 while the concrete floor would contain 45 cu. yds. which at $40.00 would add $1,800—making a total for the steel span of $11,300. The matter of economy for this critical span is a little questionable, but field painting would add $500 to the $11,300 and in addition, the saving in abutments would seem to make the odds in favor of the concrete span. We believe that we will be able to reduce the yardage somewhat when we work up the detail drawings. The 110- and 120-ft. spans will prove more economical. When our roadway widths are 22 ft. or under we use a slab floor, but for 24-ft. roadways, we feel it desirable to use transverse floor beams in about 10-ft. panels with slab floors and no stringers. For spans greater then 120 ft., we have not as yet worked out anything in concrete and will continue to use steel until we get time enough to give concrete more thorough consideration and study.

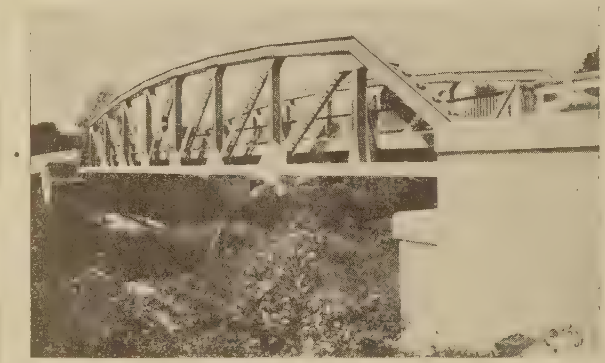


Fig. 14—Standard Low Truss with Curved Pratt Truss, a Type of Bridge Which is Being Replaced by the nStadard Concrete Designs

In the last two years, we have had many bridges on which sidewalks had to be provided. These calls include the requirement of either one or two walks and we have had a few cases where it was imperative to provide so that one or more walks might be added in the future. We therefore, for each roadway width, designed concrete girders of both light and heavy sections so that we could take care of any requirements. The light and heavy girders differ merely in width, all general dimensions and outlines and panelling remaining the same. The walks are cantilevered outside of the girders and are 5 ft. in clear width. Where future walks are to be provided, a recessed belt course is left in the outside face of the girder and the reinforcing steel for sidewalk bracket connections is terminated in hooked ends in the recessed belt course and a 1-in. bar of short length is thrust through and wired to the hooks. These bar ends are painted with asphalt and then the recessed belt course is filled with precast belt course blocks of about 3 ft. in length and of a thickness of about 2½ in. laid up in cement mortar. When it becomes desirable to add a sidewalk, the thin belt course blocks are broken and the 1-in. bars slipped aside and the sidewalk anchorage bars with hooked ends slipped in place and the 1-in. bars slipped back. All steel is then firmly wired and when all old steel is thoroughly cleaned the sidewalk is cast. Fig. 10 illustrates the manner of anchorage and the detail of this arrangement and Fig. 12 shows a finished walk in place with precast spindle railing of our standard pattern. Fig. 6 shows a 90-ft. girder with no walks, but provision for adding them at a future date on each side. When walks are used or provided for, it is usually desirable to use U abutments and continue the sidewalk railing along the wing. This is not the most economical design. We have proposed a standard drawing showing the various types of wings and parapet wing treatments for various conditions, and this drawing is shown in Fig. 9. In case a parapet wing on a 1½:1 slope is used and a future walk should be added, the parapet wing would be dowelled and extended vertically to seat the sidewalk slab.

We are now using almost exclusively an abutment design of a semi-U type. That is, the abutment is of U shape up to bridge seat elevation and from bridge seat to roadway the backwall wings extend parallel to the face of the abutment, fitting the 1½:1 slope of the backfill. For square spans and for low abutments this type is very economical. The U treatment for low abutments is secured at but little greater expense than a stub abutment. This type of abutment provides for the future by giving a wide bridge seat which will permit of a widened superstructure or for sidewalks without alteration of the original work below the bridge seat elevation. The wings would need to be extended parallel to the roadway, but this would involve no alterations or water work as a rule. This provision for widening we feel is of the utmost importance at this stage of the Highway Bridge Development in this country. One of the most serious provisions for widening for future traffic growth which faces us now is the prospect of a 40-ft. paved way from Lansing to Detroit on T. L. 16 and also the Federal Aid Road from Detroit to Toledo for which a 150-ft. right of way is being secured. It must be evident that the State can not build spans with 42-ft. roadway widths in the under clearance limits of 3 ft. to low concrete and it is also certain that it is not economical or feasible to place piers in our streams and use short slab or shallow T-Beams up to say a 30-ft. maximum. We have concluded that it is important that we be able to save our investment in the structures we build today instead of scrapping either substructure or superstructure when the day of widening comes. We have arranged to build our structures on these roads with long straight footing walls of such length as to catch the 1½:1 slopes for a 30-ft. width of grade inside of shoulders. These footing walls will extend to approximately the low water elevation for streams or to a height of 5 ft. above top or rail for grade separations in which the highway is carried over the railroad. These footing walls will be of wide sections counterforted and will project in front of the general neat line of the face of the abutment proper about 2 ft. and will carry in the top ledge two parallel lines of 60-lb. T-Rails embedded to within 1 in. of the top of rail. These rails will serve for carrying timber bents and jacking arrangements carried on grooved wheels for raising the superstructure, which will be originally built in the axis of the existing roadway, and moving these superstructures to one

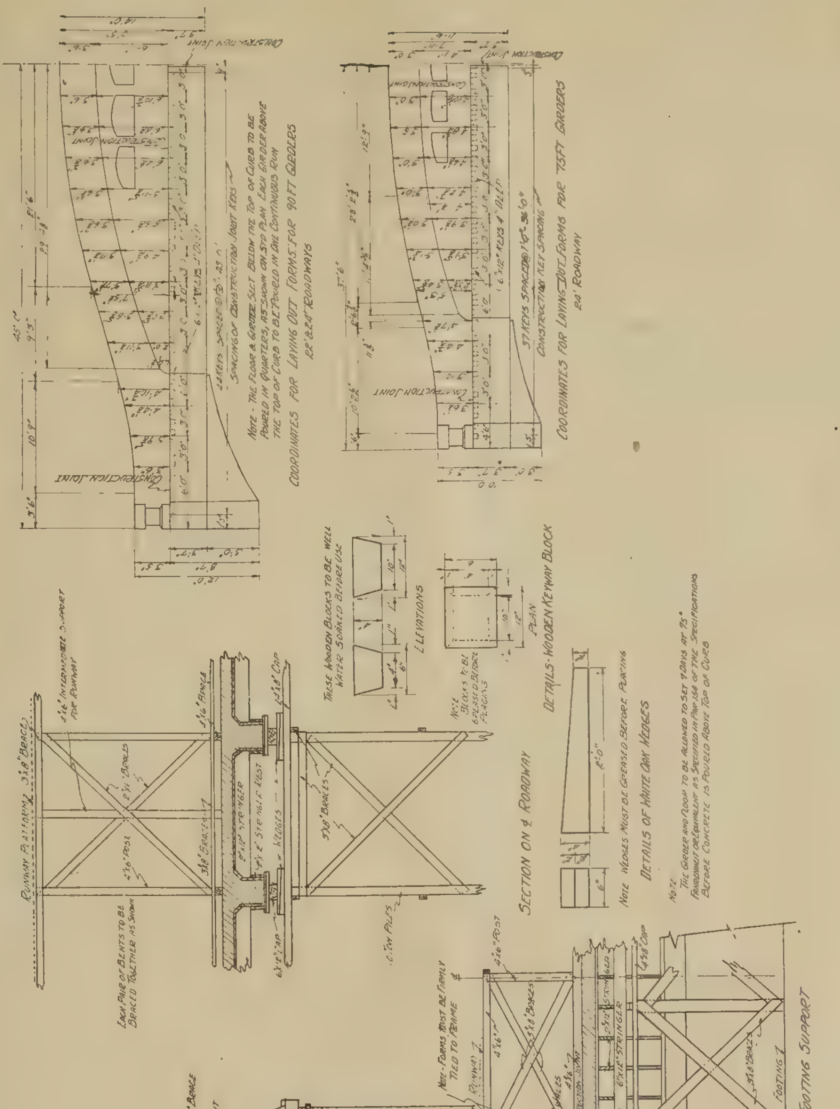

Coordinates for Laying Out Forms for 90 Ft Girders 22' & 24' Roadways
Coordinates for Laying Out Forms for 75 Ft Girders 24' Roadway
Construction Joint
Section on ℄ Roadway
Details-Wooden Keyway Block
Elevations
Plan
Details of White Oak Wedges
Runway Platform
Falsework Bent Under T Beam
Half Section-Floor Beam
Half Section-Floor T-Beam
End Bent with Footing Support
Elevation Showing Haunch
Abutment

Fig. 15—Details of Forms and Coordinates for Laying Out Forms for 75-Ft. Girder, with 24-Ft. Roadway

side, thus permitting the erection of a twin span in the future on the other side. The lift will be made with about six 50-ton jacks on each abutment with a raise of not over 1½ in. and the girder span pushed laterally by a 10-ton jack on each abutment operating against a shoulder provided in the top course of the long footing wall. The present structures will provide for a 22-ft. roadway inside of curbs and when shifted for future widening the twin spans will be separated by a distance of 40 ft. between centers of roadway. This will provide for a Boulevard approach at each end of the future structure with a width of boulevard of 18 ft. at the curb and a clear space between girders of about 12 ft. The twin spans are joined at the approaches with an open spindle rail and the boulevard is planted with shrubbery and sodded. All lighting arrangements will be placed in this boulevard space. The boulevard approaches are to be made by means of reverse curves of 1,000-ft. radius.

### Provision for Wider Roadways

We also have another solution to the demand for wider roadways which however involves the loss of the existing superstructure. The old B-1-A-5 abutments which were used so generally until two years ago will be cut down to a horizontal plane extending through the tips of the wings at their top surfaces and these wings and body capped with a belt course for bridge seat, the old superstructure being first removed. A superstructure with wider roadway and of special design will then be built on the new bridge seat and in order to avoid any foundation or water work the girders will be continued in the form of a wall of curved outline below the roadway and with concrete slab and spindle railing on top. This wall will be made long enough to catch the slope of the widened fill and retain the natural slope of 1½:1 from this point to the tip of the existing wing. These walls will have shallow footings and will be founded in the compacted soil of the old roadbed. To widen an existing structure from a 17-ft. roadway to a 24-ft. roadway, these walls will not ordinarily be longer than 12 ft. and four such walls with shallow footings are much cheaper than rebuilding the structure. It are not believed that the practice of cutting off the wings of the old structure and extending the old abutment is a desirable way of handling this problem since, in addition to being very expensive and entailing full length cofferdams, the new superstructure load will come partly on the new and partly on the old wall sections and since there is sure to be unequal settlement the structure will take very severe strains.

In addition to the concrete standards described in this paper we have been using standard low truss designs in low curved chord Pratt trusses with short panels of about 13 ft. in spans of 100, 110 and 120 ft. These structures have been provided in roadways of 18, 20, 22 and 24 ft. both with and without walks. All chords are of the open laced type without cover plates and with two rivet bar lacing. This type of structure is very satisfactory and of good appearance but will no doubt become of slight use to us when our concrete standards in these spans are ready. This type of structure is well illustrated in Fig. 14. The Department has not prepared standard bridge plans for longer spans than 120 ft. because of the infrequency of the demand for such structures. We have prepared special plans for all such cases and at the present time have under contract a 150-ft. span and another 175-ft. span Through Truss bridge.

Up until two years ago, the department did but little work in maintaining the old structures taken over by the act of Determination of our Trunk Line Highways. The State pays the full cost of maintenance on these jobs and in the past two years we have painted 118 bridges, placed new floors on 29 bridges and made repairs on 59 bridges. The State owns and operates 5 paint gun outfits with complete equipment for general repairs, each outfit being mounted on a truck equipped with pneumatic tires. We also have one Cement Gun and Air Rivetting and Erection outfit mounted on a truck with a four-wheeled trailer, both truck and trailer being equipped with pneumatic tires. Our new floor jobs, when in timber, very generally consist of 3-in. creosoted transverse subplank with 2-in. untreated longitudinal surface planking. Our paint is always a lead base paint furnished seasonally by low bidder for the season's work. All final paint coats are light or cream gray in color to serve as a safety warning to the public. We find that this color obviates the objection of rapid deterioration of white paint and, we believe, gives a pleasing finish. We naturally receive many complaints from the public criticising our conduct of bridge maintenance work. These criticisms are impossible to avoid and may in some cases be entirely just, but the fact that a painter coming on the job finds dew or rain or frost on the steel and may have to potter around a while till the sun comes out, does not necessarily mean that he is lazy. He would do the same on your house job. State-wide maintenance crews must go any place on orders. It is impossible to engage commercial crews for such a purpose and hand painting is a distinct menace to steel. We do not let erecting companies apply field coats but do this with our crews. We find that erecting crews usually hire some local men, not even painters, to daub our work up. On the other hand, we cannot expect to secure always that type of service we most desire, because floating labor, willing to go any place at a moment's notice and of excellent quality is just as hard for us to secure as it is for the individual. We do, however, require a foreman's report every week and on the report we get the man-hours of labor expended on each item of work during the week and we know the amount of material used. We have checked up the costs and labor hours for this work in many cases when complaints have been filed and we find no room for scandal arising from costs even though minor indiscretions and misconduct are sometimes undeniably proved. Our crews have had just about time enough to become well organized and settled now and we believe with Coue that "day by day they are getting better and better in every way."

## Road Investment

"Reinforced Concrete the Best Road Investment," says O.W. Fernald, president of the New Hampshire Good Roads Association and Commissioner of Public Works in Berlin, N. H. In the May issue of *Granite Monthly*, on the subject of "Berlin, N. H., A City of Opportunities Where Paved Roads Have Doubled the Loads."

Mr. Fernald writes: "The best investment this State can make with her wonderful natural resources, consisting of an unlimited supply of granite, is to build reinforced concrete roads that settle the question definitely. The very fact that we can now see every day after thirteen years of constant service the very pavements we invested our money in during 1909 is the best sort of evidence thatsuch roads are an investment and not a mere expenditure requiring periodical renewals."

# Graded Aggregate:

News, Review, Hearsay, Comment—A Department of Fragmentary Miscellanies—the material for which will be gathered from the job, the office, the factory, over the lunch table, in Pullman smokers, from the morning mail and many other sources.

## Bates Road Tests Pay 1440 Percent Dividends

It should not be necessary to offer proof of the value of research. If however there ever was a prompt and definite profit from an investment in a program of tests it is evident in the highway work of the State of Illinois, as a direct outcome of the Bates road work. The following is from a letter to CONCRETE (July 20, 1923) by Clifford Older, Chief Highway Engineer, Department of Public Works and Buildings, Springfield, Illinois:

"Previous to building and testing the Bates Road, our standard design for concrete road construction consisted of a pavement 18 ft. wide and having a uniform thickness of 8 ins. As expressed in the usual manner, the mix was 1:2:3½. This standard was adopted upon the recommendations of a conference of the highway engineers of eleven northern Mississippi Valley states.

"As a result of the preliminary work on the Bates Road, we felt that a modified design having a center longitudinal joint and providing for a continuous longitudinal bar ¾ in. in diameter along each edge of a concrete pavement having a uniform thickness of 7 in. would be fully as able to withstand modern highway traffic as the former 8-in. uniform thickness standard. This design resulted in a saving in construction cost of $1,600 per mile of road.

"Upon the conclusion of the traffic runs on the Bates Test Road last fall we were convinced that a further modification of design would result in a pavement of equal or greater load carrying capacity and with a still further reduction in first cost. Consequently, all contracts for this year's construction were awarded on the basis of this modified design, which consists of a concrete pavement 9 in. thick at the edges, tapering to 6 ins. at a distance of 2 ft. from the edge, the entire mid portion of the pavement being 6 in. thick. The longitudinal joint and ¾-in. side bars are included as in the first modified design.

"The saving in cost of construction of this design over that of the previous 7-in. standard is about $2,000 per mile. *Sufficient contracts were awarded on the 7-in. modified design (most of which have been completed) and the new 9-in. edge, 6-in. center design, which are now under construction, to effect a total saving to date of three million, six hundred and some odd thousands of dollars. The Bates Test Road has cost up to date about $250,000.*"

* * *

"EMPLOYEES SHOULD BE GIVEN PARTICIPATION IN MANAGEMENT" is the verdict of a Special Committee of the National Economic League on "Readjustment of Industrial Relations" which has made a study of 1000 plans for improved relations between employers and employees. The committee recommends that this participation should be given under certain limitations and that employees should have an opportunity to acquire some financial interest in the establishments in which they work. The Committee concludes that the term "industrial democracy" is misleading and should be abandoned; that employees, as a whole, are not interested in assuming the responsibilities of management and that, while they should be given the opportunity to have a voice in management on matters affecting their immediate welfare, it would be inadvisable to have them participate in management on questions of policy, such as selling, purchasing, finance and similar matters. The point is made in the report that employees and executives should be given more instruction in the economics of business, as a step to better industrial relations. The sub-committee of the National Economic League which made the report includes: Daniel Bloomfield, lawyer and consultant in industrial relations; Charles W. Eliot, President-Emeritus of Harvard University; Edward A. Filene, president of William Filene's Sons Co.; F. P. Cox, general manager, General Electric Co., Lynn, Mass.; James M. Head, former mayor of Nashville, Tenn.; Frederick A. Cleveland of Boston University; George E. MacIlwain of the Babson Organization; John Calder, former Industrial Relations Manager, Swift & Co.; and J. P. Snow, a Boston engineer.

* * *

## Concrete Ships

A good many people were once enthusiastic about the possibilities of concrete ships. Some believe not all the possibilities are exhausted. Following are data which some may want to clip out and put in their scrap books.

Ships completed by the Emergency Fleet Corporation of the United States Shipping Board, their builders, and principal dimensions were as follows:

| Builder | Hull | Name | Type | Designed D.W.T. | Length B.P. | Breadth Mold | Depth Mold |
|---|---|---|---|---|---|---|---|
| Fougner, C. S. B. Co. | 1189 | Polias | Cargo | 3500 | 268′5″ | 46′5″ | 26′6″ |
| Liberty S. B. Co. | 997 | Atlantus | Cargo | 3000 | 250′0″ | 43′6″ | 26′9″ |
| | 1560 | Cape Fear | Cargo | 3500 | 268′5″ | 46′0″ | 28′3″ |
| | 1562 | Sapona | Cargo | 3500 | 268′5″ | 46′0″ | 28′3″ |
| A. Bentley & Sons Co. | 1707 | Dinsmore | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |
| | 1708 | Moffitt | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |
| Fred T. Ley Co. | 1715 | Latham | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |
| | 1716 | Selma | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |
| San Francisco S. B. Co. | 1662 | Peralta | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |
| | 1663 | Palo Alto | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |
| Pacific Marine & Const. Co. | 1724 | San Pasqual | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |
| | 1723 | Cuyamaca | Tanker | 7500 | 420′0″ | 54′0″ | 36′0″ |

These vessels were built in accordance with detailed plans furnished by the Concrete Section.

The concrete mix, except the Polias, was one of cement to two of fine and coarse aggregate. The Polias was one of cement to two of sand and gravel, the sand being ¾ and the gravel being 1¼. The first ships were reinforced with square bars ⅜ in. to 1⅛ in., while the later vessels had plain round bars ⅜ in. to 1⅜ in.

Throughout the deep sea trials the vessels steered very well, requiring but little wheel to keep them on a given course. The vibration generally felt on steel vessels was not noticeable on this type of vessel, and the ship behaved in every way very satisfactorily.

The following are the voyages made by concrete vessels, including routes, approximate miles, fuel consumed, with cargo amount and kind, number of days on the voyages, approximate number of crew, and the wages per month paid them:

| Vessel | Selma | Palo Alto | San Pasqual | San Pasqual |
|---|---|---|---|---|
| Route of Voyage | Mobile-Tampico-Galveston | Never made a voyage | San Diego-Panama Canal-Tampico-Galveston | Galveston-Tampico-Baton Rouge |
| Approx. No. Miles | 1223 | | 4844 | 1224 |
| Fuel Consumed Steaming | 1610 bbls. | | 4022 bbls. | |
| Cargo and Amt. | Fuel Oil 2300 tons | | 5070 tons Crude Oil | 5162 tons Crude Oil |
| Days on Voyage | 103 | | 46 | 31 |
| No. of Crew | 42 | | 42 | |
| Mo. Amt. of Wages | $4157.00 | | $4157.00 | |

| Vessel | San Pasqual | San Pasqual | San Pasqual |
|---|---|---|---|
| Route of Voyage | Baton Rouge-New Orleans-Tampico-New Orleans | New Orleans-Tampico-New Orleans | New Orleans-Tampico-New Orleans |
| Approx. No. Miles | 1472 | 1442 | 1442 |
| Cargo and Amt. | 5160 tons Crude Oil | 5383 tons Crude Oil | 5738 tons Crude Oil |
| Days on Voyage | 31 | 11 | 30 |

| Vessel | Sapona | Sapona | Sapona | Sapona | Sapona |
|---|---|---|---|---|---|
| Route of Voyage | Jacksonville-Tampa-N. York | N. York-Norfolk-Boston-Phila. | Phila.-Providence-Balto. | Balto.-Boston-Jacksonville | Jacksonville-N.Y.-Norfolk |
| Approx. No. Miles | 2023 | 1341 | 925 | 1730 | 1084 |
| Fuel Consumed Steaming | | 138 tons Coal | 116 tons Coal | 148 tons Coal | 81 tons Coal |
| Cargo and Amt. | Phosphate | Coal Paper 1541 | Coal | Coal | Lumber |
| Days on Voyage | 25 | 18 | 27 | 46 | 35 |
| No. of Crew | 38 | | | | |
| Mo. Amt. of Wages | $3,750.00 | | | | |

| Vessel | Moffit | Latham | Latham | Latham |
|---|---|---|---|---|
| Route of Voyage | Jacksonville-Mobile | Mobile-Tampico-Phila. | Phila-Tampico-Galveston | Galveston-Mobile |
| Approx. No. Miles | 1040 | 2750 | 2473 | 437 |
| Fuel Consumed Steaming | | | | |
| Cargo and Amt. | | 7000 tons Crude Oil | 430 tons General | Light |
| Days on Voyage | | 28 | 54 | |
| No. of Crew | | 38 | 38 | |
| Mo. Amt. of Wages | | $3,750.00 | | |

| Vessel | Atlantus | Atlantus | Atlantus | Atlantus | Atlantus | Atlantus |
|---|---|---|---|---|---|---|
| Route of Voyage | Wlmngtn-Norfolk-Boston-Norfolk | Norfolk-Providence Norfolk | Norfolk-Boston-Norfolk | Norfolk-Phila.-Norfolk | Norfolk-Boston-Norfolk | Norfolk-Boston-Norfolk |
| Approx. No. Miles | 1394 | 796 | 1036 | 520 | 1036 | 1036 |
| Fuel Consumed Steaming | | | | | | |
| Cargo and Amt. | Coal 1917 tons | Coal 1988 tons | Coal 2022 tons | Coal | Coal | Coal |
| Days on Voyage | 63 | 20 | 22 | 11 | 15 | 11 |
| No. of Crew | 38 | | | | | |
| Mo. Amt. of Wages | $3,750.00 | | | | | |

| Vessel | Atlantus | Atlantus | Atlantus | Cape Fear |
|---|---|---|---|---|
| Route of Voyage | Norfolk-Boston-Norfolk | Norfolk-Boston-Jacksonville | Jacksonville-Boston-Norfolk | Jacksonville-New York |
| Approx. No. Miles | 1036 | 1555 | 1555 | 792 |
| Fuel Consumed Steaming | | | | |
| Cargo and Amt. | Coal | Coal | Lumber | Ties |
| Days on Voyage | 16 | 78 | 36 | 31 |
| No. of Crew | | | | 38 |
| Mo. Amt. of Wages | | | | $3,750.00 |

| Vessel | Cape Fear | Cape Fear | Cape Fear |
|---|---|---|---|
| Route of Voyage | New York-Norfolk-Panama Canal-Arica-Iquique Panama Canal-Martinique-St. Lucia-Cristobal | Bluefields-Colorado Bar-Cristobal-Colorado Bar-Bluefields-New York | New York-Providence-Norfolk |
| Approx. No. Miles | | 13095 | 125 |
| Fuel Consumed Steaming | | 1289 tons Coal | 20 |
| Cargo and Amt. | Coal Nitrate 3000 tons | Mahogany Logs | Light |
| Days on Voyage | | 146 | 2 |
| No. of Crew | | | |
| Mo. Amt. of Wages | | | |

S. S. "Dinsmore," "Peralta," and "Cuyamaca," never made a voyage. The S. S. "Polias" grounded off Chilly Ledge, Maine.

* * *

A "RECOMMENDED BUILDING CODE" for cities with populations of from 25,000 to 150,000 has been put out by the Portland Cement Association. It is a pamphlet of about 50 pages; 8½ x 11 in. Part I is concerned with the scope of building codes; Part II, definitions and standards; Part III, general requirements; Part IV, structural designing; Part V, factories, office and mercantile buildings; Part VI, theatres and assembly halls; Part VII, school buildings, libraries and museums; Part VIII, dwellings, apartment houses, hotels and places of detention. There is also an appendix including detail drawings. The code is issued in the interest of better and more nearly firesafe construction. It is confined to fundamental requirements and avoids unnecessary detail. Wherever standard specifications are relied upon, they are mentioned by reference and the matter not reprinted. In matters of heating and ventilation, the code states the requirements to be met and leaves it to the mechanical engineer to design the plant. Compilation of the code was undertaken after the study of a large number of city and state building codes and as a result of this study, the building code issued by the Industrial Commission of Wisconsin was followed to a large extent, although there were some modifications through further use of accepted standards of a national character.

* * *

## Concrete Products Overhead

How to distribute overhead costs in various departments of the concrete products business is a problem that is bothering one of the readers of CONCRETE who is making 400 to 500 block per day on a tamp machine in one department, besides 375 to 450 ft. of large and 1000 to 2500 ft. of small drain tile. Under full production in this plant it requires 14 men for manufacturing operation. It is pointed out by a student of products manufacturing that direct charges, such as superintendent's salary, administration expense, advertising and sales expense, depreciation of machinery and buildings, land rental, interest on investment, taxes and insurance, should all be estimated as accurately as possible in advance and reduced to an "overhead expense" per day basis. To do this, it is of course necessary to bunch all of the overhead items on an annual basis and divide the total sum by the number of days operated in the year.

Other items of manufacturing overhead expense such as power, light and fuel, liability insurance, water tax, repairs to equipment, breakage, can be estimated from experience in previous years of plant operation and pro-rated to a daily basis in the same way. After these items have been determined on an operating day basis, it is an easy matter to determine the percentage of tonnage that went into pipe and tile of various sizes and concrete block, and the apportionment of the overhead should be made accordingly on this tonnage production basis. An interesting analysis and summarized tabulation of costs in concrete block manufacture under various conditions appears as a part of the report of Committee P-6 on Products Plant Operation, John W. Lowell, Chairman, in the American Concrete Institute *Proceedings*, Vol. 19.

* * *

HOW MANY CONCRETE STAVE SILOS ARE DESTROYED BY TORNADOES? Interesting data in answers to this question have been accumulated through the efforts of the National Concrete State Silo Association, to convince insurance companies that the stave silo builders are entitled to more favorable rates. Up to July 19, reports had been secured from 41 concrete stave silo builders in 19 different states. A summary of these reports discloses that of 24,433 silos erected by them, only 29 have been demolished by tornadoes, which is less than one-eighth of 1%; some of the silos have been standing 15 years. In practically every instance where damage occurred, it was the result of a barn or some other heavy farm structure being blown against the side of the silo, causing it to fall. Numerous examples were presented where tornadoes destroyed every structure on the farmstead with the exception of the concrete stave silo and there are instances where the silos were moved off their foundations without causing them to collapse. In Fergus Falls, Minn. in 1919 a stave silo was moved 15 ft. off its foundation. According to Andrew Nordloef, the builder, it is still standing in its new location and has been filled every year just as though it were on its original base.

* * *

## Silos For Cash

In a recent issue of *Printers Ink* there appears a sales suggestion on silos. A silo manufacturer found himself with a number of 1920, 1921 and 1922 accounts that could not be collected and since a silo is a product that can not be retrieved like a piano or a "flivver," he was simply stuck. So he took the plunge and went in for a cash business. His sales returns were made an argument not for the product but for cash terms. In one of his first letters the following paragraph appeared:

> You can get about any old terms you want this year on silos—except from us. If you must have credit on a silo shop around and see what you can do. I imagine that you can get two years, perhaps longer—at a price.

Later on the manufacturer actually discouraged sales in this fashion:

> The way I look at it is this, if you have money and need a silo there never was nor never will be a better proposition that we make you this year. If you haven't money but can borrow then it will pay you to borrow and pay interest for a few months, and our cash discounts will more than cover what the bank will charge you. If you have no money and no credit at your bank then you have no business buying a silo this year. You can send all cash with order and save 10% or send $25 cash with order, paying balance on delivery, and save 5% whichever is the most convenient. In either case you get a cash discount and the price you pay has not been padded to cover bad debts.

His experience to date is that 95% of the orders come with all cash with order. In one day he banked $5000 of such advance payments.

* * *

Discussing the "Day-Labor" Work of the U. S. Government, Arthur P. Davis, as director of the United States Reclamation Service points out that "a large percentage of contractors are unreliable, bid too low and public sentiment may compel the award of the contract to the low bidder unless it can be proved beyond a doubt that he is unreliable or incompetent. This can not be proved beyond cavil, even when it is a fact and the process of so proving it is one that no man relishes, but it is something that we are inviting every time we call for bids on a large contract. It is difficult and generally embarrassing to a public officer to award a contract to any other than the lowest bidder, and to permit award to other than the lowest bidder is to invite suspicion of collusion and corruption between the awarding officer and the successful bidder." That is one reason at least why the United States Government does so much day-labor work in the Reclamation Service.

* * *

## More Roof Tile Problems

The *Hows* and *Whys* of various problems in concrete roof tile manufacture touched upon in some points previously in this department are discussed by Paul J. Hawkins of the Crawfordsville Foundry Co. in a letter to Concrete as follows:

> The permanency of color depends upon a number of different factors. The cement and the color for the top coat must be thoroughly mixed and then ground together in a dry state until all streaks disappear. This condition is reached only when a small handful of the mixed material can be smoothed over on glass surface with a trowel and absolutely all streaks disappear and the color becomes a uniform shade. The mixing and grinding can only be done satisfactorily in a colormill which has no sharp corners or voids which cannot be reached by the rolling or grinding action of the balls.
>
> Top coat cannot be mixed properly in a liquid state as done by some roof tile plants and then expect this coating to sink in or to be compressed into a wet piece of concrete. On the other hand, a dry color coat will quickly soak in and give roots to the color material which helps to grip the surface color. Unfortunately, too many roof tile plants load their color coat material too heavily with color and as a result the cement binder soon washes out.
>
> The most important feature in securing a permanent color coat is the actual care and handling of the tile after it is made. Tile should be stacked indoors for ten days after the tile are knocked off the pallets. These tile should be well sprinkled with water each day during this period. The building should be as far as possible free from draughts and sunlight.
>
> Some of the largest tile manufacturers stack their tile out in the open air and exposed to the elements as soon as they are removed from the pallets. Such colored tile cannot be expected to hold their color because the color coat will disintegrate before the tile are sufficiently cured. Tile plants should have inside storage for a ten days' production of tile to secure decent results with colored tile. Too much stress cannot be laid upon the necessity of inside storage and the application of water or moisture for the first ten days.
>
> In other words the large roof tile plants with plenty of cash capital too often economize in constructing too small a building. Personally, I believe that 75% of color troubles will disappear when the advantages of inside storage are appreciated.
>
> Any article painted or dyed will have a more lasting color if it is not exposed too soon to sunlight or draughts. And the same is even more true of colored concrete because the article colored is not cured.

* * *

Are Bricklaying and Plastering to Become Lost Arts, The *Wall Street Journal* wants to know. Editorially the paper points out that it may not be long now before it will be with the bricklayer and plasterer as it was with veterans of the War of 1812, fraudulently recruited. The National Association of Manufacturers says that the number of apprentices admitted to the Bricklayers' Union last year was less than half the number of members taken by death. At this rate, bricklaying will become a lost art and the plasterers are going still faster. The *Wall Street Journal* says "we replenish our streams with trout and we protect our song birds from extermination but we take no thought of our plasterers." By reason of the limitation of apprentices, most of our plasterers are aged men and will not be with us long. The last survivor of the plasterers' union will be regarded very much as the last survivor of the charge of Balaklava.

* * *

## Action Taken on Standardization of Horizontal Non-Tilting Drum Concrete Mixers

Fourteen provisions for standardization of concrete mixers were approved by the Joint Committee on Construction Equipment in session with members of the Associated General Contractors and representatives of mixer manufacturers at a meeting of the Joint Committee held in Chicago, June 27, 28 and 29, 1923. These provisions which cover some 30 specific points involved in the standardization of mixers, provide for a reduction in the number of types manufactured, cover the furnishing of auxiliary equipment, standard capacities and ratings and many other points of mutual interest to the manufacturer and the user of equipment. A resolution was passed providing that the Joint Committee call a meeting of all non-tilting mixer manufacturers in July to carry out the work of standardization as affecting the manufacture of their mixers.

Upon recommendation of the manufacturers present at the Chicago meeting it was agreed that the standard adopted should be designated as A. G. C. Standards pending the establishment of contact with American Engineering Standards Committee and the adoption of American standards. At the request of manufacturers also, the Joint Committee approved the use of a standard name plate to be later designed by manufacturers, giving the standard rating of the machine and its capacity for various proportions of mix, with a statement that the machine conforms with standard A. G. C. requirements.

* * *

WALTER B. ELCOCK recently division engineer of the Atlanta office of the Portland Cement Association has been appointed assistant general manager in charge of the southeastern offices of the Association. Mr. Elcock joined the Association staff in April, 1914. In 1915 he was division engineer in charge of association work in Colorado, Utah, Wyoming and Idaho. In 1916, he was appointed to the Atlanta office. He has been continuously with the Association since joining, except for two years in the army as major of infantry. Mr. Elcock's headquarters will continue to be at Atlanta. District offices of the Association have recently been opened in New Orleans, Jacksonville, Birmingham, Memphis, and one will be established in Raleigh.

* * *

## A Five-Story Block Building

An inquiry about the construction of a five-story building of concrete block in a middle southern city prompts a consideration of acceptable wall thicknesses for the various stories and heights. For ordinary construction where only the usual floor loads are obtained, where the walls are not more than 125 ft. long or with a clear span more than 26 ft., a Philadelphia building code requires the following wall thicknesses for a five-story building:

| | |
|---|---|
| Foundation | 28 inches |
| First story | 22 inches |
| 2nd & 3rd story | 18 inches |
| 4th & 5th story | 13 inches |

For a six-story building:

| | |
|---|---|
| Foundation | 28 inches |
| 1st & 2nd story | 22 inches |
| 3rd & 4th story | 18 inches |
| 5th & 6th story | 13 inches |

Walls of additional thickness are required where the length exceeds 125 ft. or the span exceeds 26 ft. It is not difficult to build a concrete block structure 5 or 6 stories high, but it is advisable, even if not demanded by the building code, to place a course of solid concrete block around the entire building wherever wall thicknesses decrease. For a wall greater than 12 inches, it would probably be necessary to obtain the required thickness through the use of two units, such as two 8-in. block for a 16-in. wall and an 8-in. and 12-in. block for a 20-in. wall and two 12-in. block for a 24-in. wall. It would be necessary to bond these units thoroughly into the wall by inserting a solid block the entire thickness of the wall every 5 or 6 courses.

* * *

J. M. MARSHALL, who has been assistant to the district engineer in charge of the New York office of the Portland Cement Association, has been appointed district engineer of the Association office at Atlanta, Ga., succeeding Walter B. Elcock. The Atlanta office has charge of the Association work in Georgia, North Carolina and South Carolina. Mr. Marshall is a graduate of the Civil Engineering Department, Virginia Military Institute, Lexington, Va. From 1905 to 1917 he did engineering work for the Seaboard Air Line and Pennsylvania railroads, the Rapid Transit Subway Construction Co., New York and for the U. S. War Department. In May 1917 he was commissioned first lieutenant of engineers and spent 18 months in France with the 11th Engineers, returning to the United States as captain in the spring of 1919 to enter the employment of the Portland Cement Association.

## Write History in Masonry

"A deluded archaeologist will write the history of America from the ruins of the Woolworth Tower and the history of Forest Hills from the pink concrete arches of that over-powering railway station. No one ever excavates market gardens or wheat fields or olive groves. The engineer and the mason hold a corner on history." So writes Simeon Strunsky editorially in the New York Evening Post, after long and frequent traveling into New York City over the Long Island railway to his editorial duties. He continues:

> The engineer, the mason and the concrete mixer deserve the posthumous credit they are in for, and especially the engineer. He is about the only man who can lift himself by his bootstraps; that is to say, he is the only man who can keep traffic going along an old railroad while he is building a new one. In the region of trans-Jamaica the engineer and the contractor are now engaged in laying new trackage, elevating and depressing roadbeds, throwing lines of shining new railway ties across the ruins of promising park "developments"—and all the time managing to get commuters all into Pennsylvania Terminal and back to their homes almost on schedule; almost, though not quite. The engineer runs his trains over apparently precarious sand piles and around the most casual corners, and the switches grind, and the train halts here and spurts there, and outside the window low-grade Mediterraneans and Alpines in sweat-soaked undershirts dig, and shovel, and heave, and drag, and you get home almost in time—almost, though not quite—and some day there will be a fine new four-track railroad built under your flying wheels.
>
> Perhaps that is what people mean when they want the engineers to tackle the job of world reconstruction. If anybody can somehow manage to keep the old world going while building a new one under its feet it ought to be the engineers.

* * *

IT IS WELL FOR CONCRETE BLOCK MANUFACTURERS ALWAYS TO BE ON THE SIDE OF THE BUILDING AUTHORITIES. If a code needs to be changed, it should always be undertaken on the basis of greater good to the building public, and cooperation should be offered to the Building Department in getting together any information for effecting any desired changes. Always make an effort to have the standards put just a little higher and not just a little lower, unless the standards are such as to work an actual hardship on the building public, with unnecessarily rigid restrictions. Building codes are primarily intended for the protection of the public. Never appear in the position of not wishing to protect the public.

* * *

## Concrete Sewer Pipe in San Diego

Fifteen years experience with concrete pipe for sewers are outlined in a letter to M. W. Loving, secretary American Concrete Pipe Assn. by William B. Harper, superintendent of sewers, San Diego, Calif. The first line laid was the C Street main, in 1908. For several years after that time both clay and concrete pipe were used, but since 1916 concrete has been used exclusively.

The city now (June 12, 1923) has 75 miles of concrete mains, varying in size from 6 in. to 24 in. The small maximum size of main is due to the fact that the city has eight outfalls to the bay.

In addition, a great quantity of 4 in. and 6 in. pipe has been used for house connections and laterals—in the last 18 months 80,000 ft. of 4 in. and 6 in. concrete pipe have been used in house connections. Mr. Harper's letter continues:

> Frequent inspections of lines show the concrete to be in perfect condition. About the first of May of this year a section of the Chollas outfall, built in 1912, was opened to show the condition of the pipe to some visiting engineers and the concrete was in perfect shape, both above and below the flow line.
>
> Aside from a small saving in first cost resulting from the use of concrete pipe, we find other advantages. A great proportion of our sewer stoppages are the result of tree roots getting in at the joints. During the year 1922, there were reported 614 stoppages,

of which approximately 60% were caused by roots. Due to the exceptionally good bond between the mortar and the concrete pipe none of the root stoppages were on concrete lines. In all our experience, the root stoppages in concrete lines have not exceeded eight in number, and those isolated cases have been plainly due to poor construction.

We find another advantage in being able to cut into a section of concrete pipe without danger of damaging the pipe. Where Ys are placed when a line is constructed, it is only chance if it proves to be properly located for subsequent building operations, consequently a great deal of money is wasted in dropping Ys which are never used. Our practice is to lay no Ys but to break into a line wherever necessary or convenient and cement on an eighth bend. With concrete we can cut in in this manner without shattering the pipe itself. Incidentally all tap-ins or house connections from the main to the property line are made by city forces.

The topography of San Diego is quite broken, and we frequently find it necessary to lower existing sewer mains to conform to subsequent street grades. With concrete pipe the salvage value is great. Only recently we lowered 104 ft. of main with the loss of but three lengths of pipe. As the joints are as strong or stronger than the body of the pipe, we handle such work in twenty-five or thirty foot sections whatever the men can handily pick up and lay out of the trench.

Illustrating the great joint strength of concrete construction, during the heavy rains of 1916 a section of the 24-in. line on the Chollas outfall was washed out. A 17½-ft. section hung suspended for two months with no leaks. Again, in 1912, heavy rains caused a washout about 50 ft. long on the same line and but one length of pipe was broken.

Where we encounter clay pipe in lowering mains because of grade changes, we make a practice of relaying with concrete, as the salvage value is very low on the clay pipe and is offset by the lowering of maintenance cost with concrete.

I can say, then, that the lessened first cost, lowered maintenance charges, ease with which connections can be made, and greater structural strength, coupled with the fact that inspection shows our old lines to be in perfect shape and the concrete as hard or harder than when laid, has made our experience with concrete pipe in sewer construction a happy one, and ample justification of the policy established some seven years ago of specifying concrete exclusively for sewer construction.

* * *

As to Steel Rings vs. Anneal Wire for Hooping, E. A. May, Fort Worth, Texas, writes us: "In Mr. Kircher's article in your May number he says, 'Welded steel rings form the hooping.' I suppose they are good. I have a long time used No. 3 annealed wire for spiral both on piles and columns, and have yet to find an objection. It is plenty strong, works easily, does not require bending and costs less. We make a template or enough of them to hold the vertical steel firmly on horses, about breast high, put on a coil of wire and tie in. These men work best two to tie and one to turn the wire coil."

* * *

## Concrete Floor Test

The hollow tile and reinforced concrete floors of the Arlington Building, Washington, D. C., occupied by the U. S. Veterans Bureau, were tested by loading them and measuring the deformation. Tiles were in rows 4 in. in each direction; reinforcing steel in these spaces near bottom of slab in the panel and near top across supporting beams. The concrete was poured around the reinforcing bars and into the open ends of the tiles. The building was intended for a hotel but was later turned over to the government for the use of the Veterans Bureau. The original design load of 75 lbs. per sq. ft. was increased to 100 lbs. per sq. ft. and the increased strength obtained by a 2-in. layer of concrete over the tops of the tiles.

The floor panels were loaded with sand bags up to 380 lbs. per sq. ft. and the stresses in the steel and the concrete measured. The maximum stresses developed in the steel reinforcement were about 27,000 lbs. per sq. in., and those in the concrete about 1,600 lbs. per sq. in. The effect of time under load was to increase the stresses in the reinforcing steel from 15 to 20%. This was particularly pronounced in the first 20 hours and was comparatively small later.

The panels tested varied in the ratio of length to width. It was found that with the increase of that ratio, the stresses in the reinforcing steel at the bottom of the slab and those at the top of the slab (across the girders) increased in the direction of the short span and decreased in the long one. The stresses in the girders were lower than those in the slab. The factor of safety of the structure was greater than two. These tests are described in Technologic Paper No. 236 of the Bureau of Standards, copies of which can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 cents.

* * *

F. H. Rood Has Been Made Engineer of Tests of the Pittsburgh Testing Laboratory, succeeding P. J. Freeman, resigned. Mr. Rood is a civil engineer graduate of Syracuse University; for many years engineer of tests of the New York Highway Commission, three years assistant engineer of tests of the Pittsburgh Testing Laboratory and for two years a Research engineer with the U. S. Bureau of Public Roads.

* * *

## Decoloration of Marble Facings

The gradual dimming of the polish of some marble slabs used as facings for concrete structures was recently examined, says *Tonindustrie Zeitung*. The loss of polish was found to be the result of chemical reaction; it was also accomplanied by a scum which was clearly traced to the cement. Moisture in the concrete, and still more in the brickwork backing, gradually penetrated through the marble facing, carrying with it solutions of salts derived from the cement, which caused the defect. Only the thinner slabs of marble were affected, as the thicker masses of marble did not permit the percolation of the water. Pillars of reinforced concrete, to which the marble slabs were attached direct, without any intervening air-spaces through which the moisture could enter, showed the defect to a much smaller extent than brickwork, to which water had more ready access. The defect was most noticeable near the joints in the marble, i. e., in those places where moisture might be expected to have the most ready access. By preventing the access of moisture to the back of the marble all further production of the defect has been avoided.

* * *

Comparative Construction Costs with Clay Brick at $18.00 per M. or Cinder Concrete Block at 20c apiece, in eastern Pennsylvania, developed the following figures: The cinder block cost 20c each, on the job, 6c to lay, 2c for mortar with a total laid up cost of 28c. Eleven brick required to displace one cinder block cost 20c. It cost 14c to lay them, 4½c for mortar, a total of 38½c as compared with 28c for block.

* * *

How to Build Septic Tanks of various types, privy vaults, water supply curbs and protecting walls and how to exclude the rat from farm buildings is told with illustrations in a new publication of the Portland Cement Association under the title "Concrete in Home Sanitation." It consists of 16 pages and cover, 6 x 9.

# Concrete Brick Manufacture

Concrete brick manufacture is the subject matter of many inquiries received by CONCRETE lately. That is a natural result of a changed market condition, and of test data to which this magazine has given a good deal of attention, establishing very conclusively the superior qualities of well made concrete brick for building construction.

There are many markets where concrete common brick may compete favorably with clay common brick. The number of clay brick producing plants diminishes year by year as city land values advance to a point which makes clay land more valuable as building land and because the present high freight rates on brick have closed city markets to many clay brick plants in rural districts.

It used to be very difficult for the manufacturer of concrete brick to produce a unit at the prevailing market prices of clay brick and sell it at a profit. This condition has been materially changed and now, with the prevailing freight rates and high prices of coal and labor (which seem likely to prevail for an indefinite period), it is possible in many places to produce concrete brick at a cost which meets competition and makes an attractive return. The following data in regard to concrete brick are supplied by the Portland Cement Association:

Some of the principal manufacturers of concrete common brick and their daily capacity and type of equipment are:

| Name | Location | Daily Capacity | Type of Equipment |
|---|---|---|---|
| Crozier-Straub, Inc. | New York, N. Y. | 100,000 | Crozier |
| Farmingdale Cement Brick Co. | Farmingdale, N. Y. | 180,000 | Peerless |
| Adamantex Brick Co., Inc. | Baltimore, Md. | 100,000 | Anchor |
| Adamantex Ct. Brick Co. | Brooklyn, N. Y. | 100,000 | Peerless |
| Schafer Brothers | Rochester, N. Y. | 30,000 | Besser |
| Charles V. Walsh Co. | Philadelphia, Pa. | 60,000 | Besser |
| E. E. Fellebaum | Toledo, Ohio | 60,000 | Besser |
| Birmingham Slag Co. | Birmingham, Ala. | 30,000 | Shope |
| Rock Cement Brick Co. | Buffalo, N. Y. | 30,000 | Peerless |
| Wilson, Burnett, Pfrehl Co. | Buffalo, N. Y. | 30,000 | Besser |
| Wilson Concrete Prod. Corp. | Lockport, N. Y. | 30,000 | Besser |
| Shope Brick Co. | Portland, Ore. | 40,000 | Shope |

Crozier-Straub Inc. produced 20,000,000 brick in 1922, half of which were used in new public school construction throughout Brooklyn. A detailed description of the layout and operation of this plant appeared in CONCRETE for February, 1921. A description of the Adamantex Brick Co. plant at Baltimore appeared in the December 1922 issue of CONCRETE.

Here is a typical estimate of the cost of making concrete brick. This is based upon conditions existing December 1922 in a Philadelphia plant. In considering the cost of operating a new brick plant each of these figures should be carefully checked and corrected for local prices and conditions.

Using well graded aggregate, 3/8-in. and down, the cement content provided for will produce a brick strength of 2000 pounds per sq. in.

CONCRETE BRICK MANUFACTURE
45,000 Common Brick Per 10-hour Day

MACHINERY SCHEDULE

| | | | |
|---|---|---|---|
| Machine | $12,000* | Building...... | $2,000 |
| 7,500 Pallets at 50c each | 3,750 | Curing Rooms | 2,500 |
| Cars and Track or Lift Trucks and Racks | 2,000 | Material bins | 2,500 |
| Mixer | 700 | Curing Equipment incl. boiler and pipe | 1,500 |
| Motor | 500 | Contingent | 1,000 |
| Shafting, Belts, etc. | 200 | | $9,500 |
| Screen and mat. conveyor | 900 | | |
| Installation | 500 | | |
| Tools | 100 | | |
| Freight on machine and mixer | 125 | | |
| Miscellaneous | 725 | | |
| Total Mechanical Equipment | $21,500 | | |
| Total Building Investment | 9,500 | | |
| Total Plant Investment | | | $31,000 |
| Additional Operating Capital | | | 20,000 |
| Total Capital Investment | | | $51,000 |

COST OF MANUFACTURING

45,000 brick per 10 hr. day Size standard 3¾x2¼x8" Mix 1 to 6
250 Operating Days per Year

| | | | | Days Run | Cost per 1000 Units |
|---|---|---|---|---|---|
| 7 Sacks per 1000 | | | | | |
| Cement | 315 sacks at | $ .70 | | $220.50 | $4.90 |
| Aggregate | 72.5 cu. yds. at | 2.00 | | 145.00 | 3.22 |
| Direct Labor | 1 operator at | $6.50 | 6.50 | | |
| | 2 off bearers at | 6.50 | 13.00 | | |
| 1 agg. man | | | | | |
| 1 pallet feeder | | | | | |
| 1 car man— | 3 helpers at | 6.50 | 19.50 | | |
| | 4 yard men at | 6.50 | 26.00 | | |
| | 1 mixer man at | 7.00 | 7.00 | | |
| | 2 firemen at | 6.50 | 13.00 | | |
| | 1 foreman at | 10.00 | 10.00 | | |
| | Daily labor | | | 95.00 | 2.11 |
| Manufacturing Expense (per day) | Liability Insurance 4% | | $3.80 | | |
| | Water | | 1.00 | | |
| | Fuel (curing and heating) | | 10.00 | | |
| | Power and light | | 2.50 | | |
| | Repairs to Equipment | | 4.00 | | |
| | Breakage | | | | |
| | Miscellaneous | | 5.00 | | |
| | General Expense | | | 26.30 | .58 |
| Depreciation and Obsolescence— | | | | | |
| Equipment | 20% of $21,525 — | $4,300 yr. | | | |
| Buildings | 5% of 9,500 — | 475 yr. | | | |
| Interest on Investment | 7% of 51,000 — | 3,570 yr. | | | |
| Taxes and Insurance | | 1,500 yr. | | | |
| Land rental assumed | 6% on 10,000 — | 600 yr. | | | |
| Total Overhead per year | | $10,445 yr. | | | |
| Total Overhead per Operating day | | | | 41.78 | .93 |
| Total Daily Cost | | | | 528.58 | |
| Total Yard Cost of 1000 brick | | | | | 11.74 |

To this cost must be added, selling expense, delivery cost and profit to determine selling cost.

A plant of the approximate capacity detailed above seems to approach maximum efficiency with present methods and operating equipment. Were the output of this plant doubled or tripled, practically the same unit costs would obtain per 1,000 brick of output. A small saving would be realized in the items of manufacturing expense and general expense, but not enough difference would be made to appreciably lower the cost of manufacture. A smaller machine rated at 30,000 per day and producing about 5,000,000 to 7,000,000 brick per annum would cost proportionately less to install but operating costs might work out as much as $1.00 per thousand higher. We do not recommend establishment of plants with smaller capacity than 25,000 brick per day.

In the manufacture of concrete brick, it is essential that every detail of production routine whould be directed to obtaining maximum efficiency of the portland cement content. The cost of the cement is nearly equal to the combined cost of all other manufacturing expense. This makes it doubly important that only well graded, clean aggregate and sufficient mixing water should be used and that the product should be carefully cured.

The general sales policy on the part of leading clay producers is to sell their product direct to contractors rather than through dealers. Some brick manufacturers have trade connections with building material dealers within their competitive shipping territory, but these dealers as a general thing do not carry a large stock and requirements of any consequence are nearly always purchased direct from the brick producer.

The manufacturer of concrete brick must anticipate considerable sales resistance in introducing this product. Old prejudices for materials in general use for generations can be set aside only by aggressive salesmanship. Masons offer excuses of the unit being too dense to permit proper suction with the mortar too hard to easily break with a trowel and complain of the edges being too square and sharp, cutting their hands in laying.

All of these so-called objections serve to bring out the better waterproof, strength and appearance qualities of concrete brick when built into a wall. See reports of Columbia University Tests in CONCRETE, July 1922 and May 1923 and editorial in August 1923 issue.

The objections of masons have been overcome in those communities where concrete brick are produced on a sufficiently large scale to permit the general run of mechanics to become familiar with them. Good salesmanship will convince owners and contractors that they will get a better looking, stronger wall with concrete brick. As masons become more accustomed to them, their objections will diminish. The following letter of Wells Bros., prominent contractors, by P. A. Wells, illustrates what can be accomplished.

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"In connection with the construction of the new Montgomery Ward & Co. building at Portland we had occasion to use approximately 1,000,000 common brick and 200,000 face brick.

"We were approached by Mr. Shope of the Shope Brick Co. with a view of using his brick, a cement product. I am frank to say that the writer and Mr. W. H. McCaully, engineer for Montgomery Ward & Co., were not at all familiar with this product and had never used any product of this nature in any kind of construction. They were such a clean cut looking proposition and the effects to be obtained from the face brick were so varied that we decided to investigate this material.

"The price of these brick was a trifle higher than the clay product as far as the common brick was concerned, but as the size was also larger we figured out that it would be a stand-off as far as cost was concerned with possibly a slight saving in laying and in mortar materials.

"We visited a number of structures that had been built for some three to five years and found that the results were satisfactory, showing no signs of fading or of deterioration from the weather.

"The next point that we raised was the question of the waterproof qualities of the common brick. We found that absorption was practically the same as that of a clay brick but in this case, as it was an experiment with us, we decided to use a common brick with a trowel surface on the side exposed to the weather to insure even higher waterproof qualities than obtained in common brick, as the atmospheric conditions in Portland are such that considerable trouble is found in all buildings because of dampness.

"The results we have obtained have been highly satisfactory and we should not hesitate to use this product in the future in case the opportunity arises."

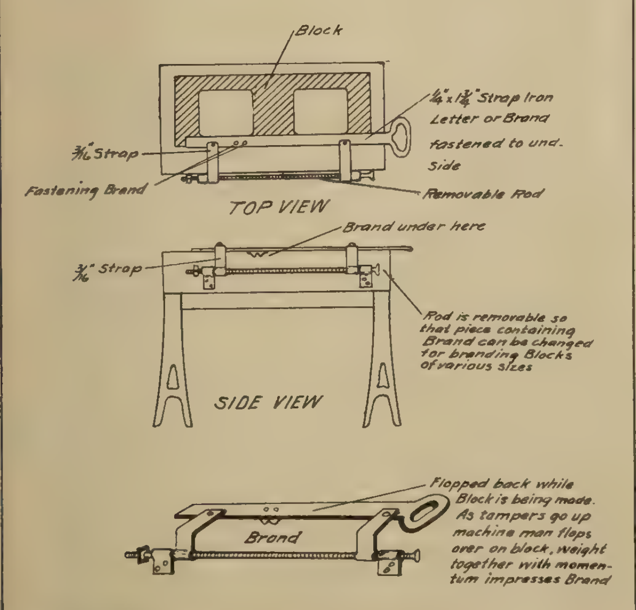
In some localities difficulties may also be experienced with Insurance Underwriters and Building Commissioners. Here again, the plant that is on a large scale production basis encounters little trouble in convincing those officials that concrete brick are units second to none in quality.

Organized labor may also offer trouble to brick manufacturers operating open shop. As a general thing however, this point is not raised.

Deliveries of brick to the job are generally made by the brick manufacturer in his own trucks. For this purpose heavy trucks up to 10 tons capacity are used mounting special bodies designed to dump close to the street or onto a brick pile with a minimum drop. A truck usually carries about 3,000 brick per load.

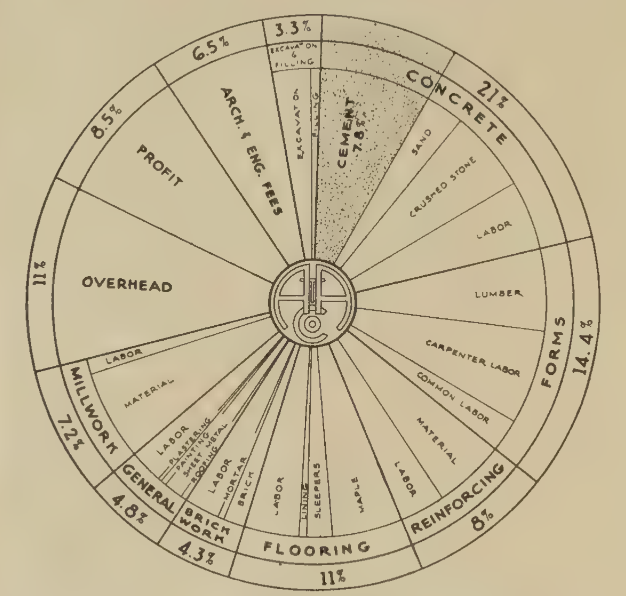
# Branding Stripper Block

Branding stripper block is accomplished by a very simple attachment as shown by the accompanying sketches. This idea is in operation at the plant of the Prairie Concrete Products Co., Prairie du Chien, Wis., and is proving eminently successful. Building regulations in many places now require that concrete building unit manufacturers brand their products so they are distinguishable when delivered on the job. It is a regulation which is a good thing for the manufacturers themselves, since it has the psychological effect of insistence upon standard quality day in and day out.


Block
¼"x1¾" Strap Iron Letter or Brand fastened to und. Side
3/16" Strap
Fastening Brand
Removable Rod
TOP VIEW
Brand under here
3/16" Strap
Rod is removable so that piece containing Brand can be changed for branding Blocks of various sizes
SIDE VIEW
Flopped back while Block is being made. As tampers go up machine man flops over on block, weight together with momentum impresses Brand
Brand

# Cost of Cement and Concrete for a Concrete Building

The accompanying chart showing the distribution of construction costs of a 6-story reinforced concrete building of mushroom type, 100 ft. x 150 ft., has been prepared by the American Appraisal Co. and reproduced in Alpha Aids by the Alpha Portland Cement Co. Overhead and profit are figured at 15% and 10% respectively on contractor's direct costs and architect fees at 7% on total including overhead and profit. Prices used in arriving at the percentage of distribution are average prices prevailing February 1, 1923. It will be noted that 21% of the cost is for concrete and only 7.8% for cement.



Distribution of Construction Costs of 6-Story Reinforced Concrete Building

## Concrete Interior Replaces Inflammable Construction

The picture shows what remains of the Tull & Gibbs building, a 4-story warehouse in Spokane, Wash., the interior of which was recently destroyed by fire and is now being replaced with a reinforced concrete interior. Before the fire this building had a wooden interior of ordinary construction, all of which was completely consumed by the flames. The exterior walls were left standing intact; consequently the owners saw the opportunity to prevent a similar loss and interruption to their business by rebuilding the floors, roof and columns of reinforced concrete.

# Concreting Plant for Street Elevation

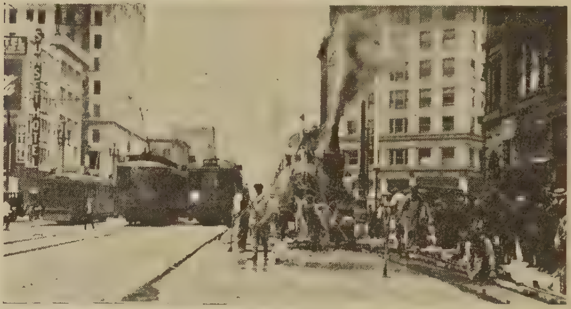
Construction operations were recently carried out in San Francisco, Calif., to raise and reconstruct the street car tracks on lower Market Street and to reconstruct the pavement of concrete bringing it up to the grade of the car track. In order to make the best use of the time during which construction work could be carried on, a special concrete mixing plant was equipped with flanged wheels so as to operate over the car tracks.

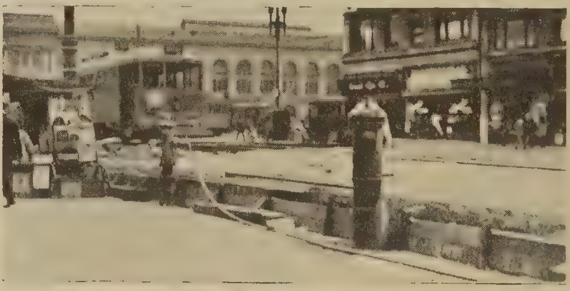
The raised grades were made necessary by the gradual settling of the region, which was reclaimed from the bay and filled in. The sinking has been at the rate of about an inch a year. At some points, the street car tracks and pavement were raised as much as 24 in., but in most places the maximum was 18 in. The worst phase of the higher grading is located on the north side of Market Street between the Embarcadero and Drumm Street. In this section it was necessary to raise the sidewalk frontings at several points, from 18 in. to 24 in. Raising the sidewalk grade necessitated the remodeling of many store fronts and basement girders to support the increased sidewalk grade, and extension of street elevators. In order to raise the sidewalk grade, sand will be placed on the present sidewalks, after which a 4-in. concrete base and 1½-in. concrete top will be laid. The cost of the sidewalk work will be paid by the property owners and it is estimated that the cost will be about $5 per foot.

The maximum elevation of 18 in. was necessary in order to insure sanitation through proper drainage. Less elevation than that would mean improper drainage.

The sinking of the area, which is not confined alone to lower Market Street but to buildings and land in the vicinity, is due to heavy construction over the reclaimed area and increased traffic. Buildings that were constructed on a foundation of longer piles have not sunk so appreciably as those built on weaker foundations.

The Board of Public Works appreciated the necessity of getting the paving work done as quickly as possible so that traffic interruption should be brief, and as a result a special shift of 18 men was started working June 24 continuing from 9:30 in the morning until 8 o'clock at night, working on the first block which was the hardest problem of all, because of the great difference between the grade of the street and the level to which the street and sidewalks had sunk. During this first day a total of approximately 7,530 sq. ft. of concrete was placed to a depth ranging from 8½ in. to 10 in. At some of the points a sand fill was placed over the old pavement and wet down and the new concrete base poured on top of this. The area completed the first day was 470 ft. long and 16 ft. wide. A 2-ft. concrete gutter raised 3½ in. above the concrete base was poured for the entire length of 470 ft. This was colored with lamp black which leaves a grey finish and does away with the unsightly streaks of oil that may drop from motor cars. The concrete work the first day, included the pouring of a concrete wall 12 in. high and 8 in. thick back of the curb to hold the curb stones in place. Before the stone curb was laid, a concrete wall about 14 in. deep was poured which extended down to and became an extension to the old retaining wall, the purpose being to keep storm water from cellars along Market Street. The 1:2½:5 mix was better than that usually used for concrete pavement base, this being done so that pneumatic tired vehicles could drive over the street in three or four days after the concrete was poured. The crushed rock and sand were brought to the street work as the concreting progressed and in spite of the difficulties, traffic was never held up longer than 2 minutes at a time. The men had to wheel the crushed rock and sand in many places up onto the street car tracks to reach the mixer, and this between street cars. A steam operated Foote concrete mixer was used on the job.





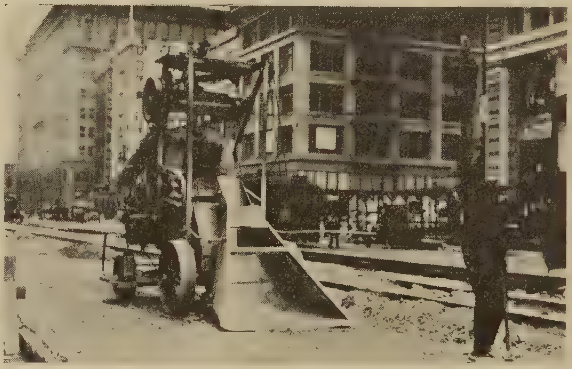


Fig. 1—Raising Manholes in Advance ofet Stre Elevation Work

Fig. 2—Raising the Level of the Street and Building New Concrete Paving

Fig. 3—Concrete Wall Placed Back of Stone Curb. Sidewalk Level to Be Raised by Concrete Slab on Top of Layer of Sand

Fig. 4—Electrically Operated Mixer Used by the Street Railway Forces for Pouring Concrete Between Rails. Flanged Wheels Provided for Operating on Car Tracks

The work of raising and reconstructing the street car tracks on Market Street was done between midnight and morning so as to interfere as little as possible with the schedules of the Market Street railway and the municipal railway. There are four street car tracks on

Market Street. The Market Street railway pays for the cost of reconstructing and raising the two inner tracks and one-half of the cost of raising and reconstructing the two outer tracks, while the San Francisco Municipal Railways pay for one-half of the cost of raising and reconstructing the outer tracks.

As shown in the illustrations, the two trolley tracks on the north side of Market Street were raised and reconstructed first. During the time between 11:45 p. m. and 5:45 a. m. all passenger street cars were kept off these two tracks, this being made possible by the use of a permanent crossover installed on Market Street near Second Street, which was used to turn back all inbound cars.

One of the two tracks reconstructed was used for the construction equipment while the other was being torn up and the new track laid down. The paving and concrete base were broken up by a 3,000-lb. drop hammer and pneumatic cutters. The rails and ties and broken concrete and pavement were removed and placed onto work cars and new ties and rails put in their place. Another gang followed the construction crew and raised the track. After this crew came the concreting crew. As the tracks for several blocks were about 24 in. above the adjacent street, the concrete mixer, equipped with flanged wheels and an electric motor and trolley pole so it could travel along the track by its own power, operated on one of the two tracks while pouring the concrete base. Placed on the tie rods ahead of the mixer was a special portable platform, 10 ft. long for mixing purposes.

In the morning, the concrete mixer was usually run to a point in front of the San Francisco Ferry Building and removed from the street car tracks and parked until the next night. Sometimes the mixer was lifted from the track by a crane and placed along side the track until the next night.

Light for carrying on the night operations was provided by placing three powerful electric lights with reflectors on each of the trolley supports.

The manholes for gas and electric conduits, telephone and telegraph wires and sewers were also raised, this work being done by the various public service companies and city sewer department. In most cases a form was built around the manhole and concrete poured to bring the top of the man hole to the prescribed elevation. This work was carried on in advance of the concreting of the street and tracks.

# Lower Construction Costs in Reclamation Work

Some classes of construction work which are fairly comparable from year to year are dealt with in an article in the *Reclamation Record* from which the following is abstracted.

The following unit costs include overhead expense:

| Items | Unit of measure | Calendar year | | |
|---|---|---|---|---|
| | | 1920 | 1921 | 1922 |
| Concrete lining and plain concrete......... | Cu. yd. | $18.45 | $16.60 | $15.55 |
| Reinforced concrete...................... | " " | 44.70 | 30.40 | 26.70 |
| Canal and drain excavation by machine..... | " " | .145 | .15 | .12 |
| Canal and lateral excavation by teams...... | " " | .37 | .24 | .21 |

Construction costs are subject to sudden changes more than nearly any other class of work, owing principally to labor and market conditions. During periods of high wages caused by labor shortage it is impossible to get the same production. Labor turnover is greater and is less efficient. Manufacturers have plenty of orders and are not so anxious to bid close in order to secure business.

The situation requires close cooperation between the field forces and the central control offices to secure the best results. The central offices are in a better position to provide engineers and foremen with experience to take charge, are in closer touch with the labor conditions and can control the local wage scale, are informed as to the condition of the market for materials needed, and have an organization trained in laying out and directing the work in the most economical manner.

During high labor costs it was found that it would be impossible to continue construction work by man and team methods and keep costs anywhere within a reasonable figure. The standard stock excavating machines manufactured by the leaders in these lines were not giving satisfactory results, so the service detailed some of its best engineers to the task of developing, in cooperation with the manufacturers of drag-line machinery, a machine that could be more easily moved and that would use gasoline or oil in place of coal, which latter was expensive. They also re-designed certain parts that were continually breaking, causing expensive delays.

This resulted in securing two types of machine in particular that moved earth at a field cost about one-half that of man and team methods, as shown above in the comparison of unit costs between excavation by machine and by teams.

The reduction in concrete work, both plain and reinforced from 1920 to 1921 was due, in part, to lower costs for cement and reinforcing steel, but the greater part of the reduction in 1921 and 1922 was due to securing small contractors to haul cement, sand and gravel on a yardage basis rather than on a daily basis and also by the standardization of structures and methods. This standardization cut the cost in form building and increased the efficiency of the employees, owing to their familiarity with the work to be done.

## Overall Aristocracy

There is a certain aristocracy of overalls to which this magazine would like to give more attention. There are men who attach a monumental dignity to a dirty-handed job, because they tackle it with intelligent interest, handle it with skill, and carry it through with painstaking care, with such pride in the result that the big executives couldn't possibly get along without them.

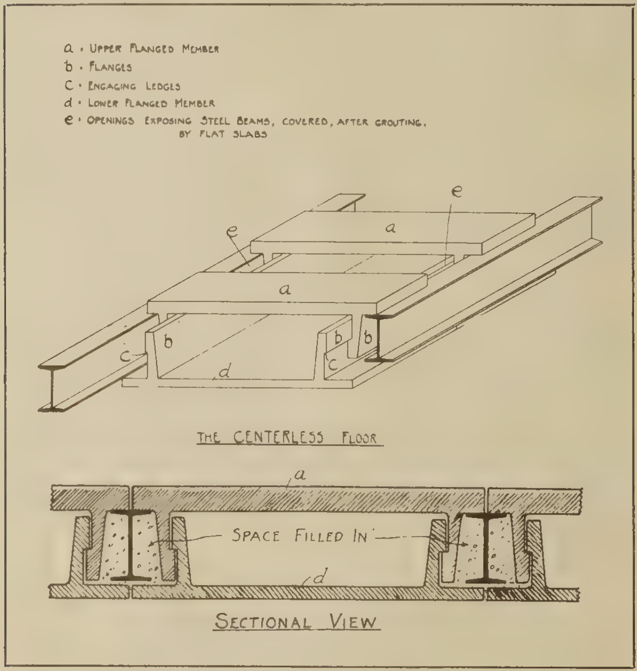
Now, who is there in your organization on whose skill and dependability you count a good deal to get the job done, whether in driving a truck, building forms, running a mixer, finnishing a floor or any other one of the jobs that simply have to be done, and have to be done right in order that the whole organization's achievement may actually be realized? Send us his picture, on the job, and tell us about him.—Editor

# A Centerless Concrete Floor

The accompanying diagram illustrates the details of a centerless, fire resisting, hollow concrete floor, designed by Frederick Rings, civil engineer, 34 Victoria St., Westminister, London.

This floor, which has recently been the subject of world wide patent applications, is designed for use in steel framed buildings. It possesses several novel and interesting features, as the illustration shows, and is claimed to have the great merits of cheapness and rapidity in manufacture and erection.

It consists of three precast units, an upper flanged member, a lower flanged member and a plain slab. These units can be made by machine either at a central workshop or at the site of building. Reinforcement is inserted to suit the circumstances. The normal width of the upper members and plain slabs is 9 in., that of the lower members 18 in. The steel I-beams are spaced at 3 ft. centers.



The Centerless Floor

Sectional View

The process of construction is as follows:

First an upper member is laid in place on the I-beams. Then a lower member is raised from below and slid into place under the upper member, the ledges on its flanges engaging with those on the flanges of the upper member, the lower member then hangs from the upper member, projecting 4½ in. beyond it on each side. This process is repeated until a complete bay is laid. At this stage the ceiling is continuous, but the floor consists of a succession of 9-in. slabs and 9-in. gaps. In these gaps are exposed the I-beam and the upstanding flanges of the lower members. When two or more bays have been completed to this stage, the joints in the ceiling slabs are pointed, and cement grout is poured in from above through the gaps to fill the space between the ceiling slabs and the I-beam. Then fine cement concrete is filled in up to the level of the tops of the I-beams, and the plain flat slabs dropped into place to complete the floor.

Advantages claimed for the floor are:

No centering required; floor can be used to carry load as soon as the upper members are laid; light weight of individual parts; minimum of finishing work to complete floor and ceiling, owing to the fine finish produced by the machine; concrete covering for the protection of the steel placed with utmost facility, rapidity and certainty as to result; rapidity of manufacture of members—the machine can turn out more than 20 per hour; continuous hollow spaces for ventilating, heating, electric cables, etc.; floor is sound proof; cost of floor and ceiling completely finished is less than by any other system.

The ceiling member can be cast in gypsum with a suitable aggregate and by this means the cost is still further reduced and the possibility of condensation avoided.

# Large Concrete Mixers Shipped to Canada

Two 4-yd. (112-S) Smith tilting mixers have been shipped to Herbertsville, Canada, by the T. L. Smith Co. Milwaukee, for use on the hydraulic dam project at Herbertsville. These mixers are duplicates of the the two that were used on the Muscle Shoals, and are reported by the manufacturers to be twice as large as any other concrete mixer ever built. The Herbertsville project on which the mixers will be used will be one of the largest on the American continent.

Four more 56-S, 2-yd. mixers of this same type are now being built for use on the Wilson dam project across the Tennessee river at the foot of Muscle Shoals on which two of the Smith 4-yd. and 2-yd. tilting mixers were formerly used. The concrete to be poured in the completion of the Wilson dam project will total 1,260,000 cu. yds.

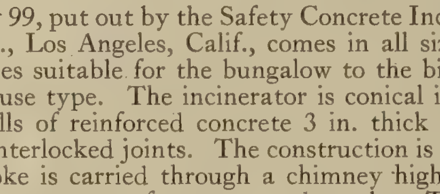
# A Concrete Incinerator

Safety 99, put out by the Safety Concrete Incinerator Co., Inc., Los Angeles, Calif., comes in all sizes from small ones suitable for the bungalow to the big apartment house type. The incinerator is conical in shape, with walls of reinforced concrete 3 in. thick and two double interlocked joints. The construction is fireproof and smoke is carried through a chimney high enough to avoid annoyance from soot and sparks. The company claims permanence, simple construction (2 parts only), easy moving, fire safety and a grate insuring complete combination.

# The Syntron Electric Hammer

The Syntron electric hammer put on the market by the National Electric Manufacturing Co., Pittsburgh, Pa. is recommended by the manufacturers for drilling or chipping. It will drill, they say, a 1-in. hole 3 in. deep in dense hard concrete in one minute.

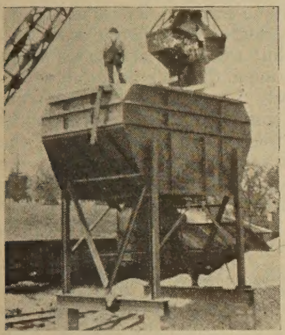
To operate, it is only necessary to plug into an alternating current light socket, place the tool against the work and pull the trigger. The Syntron uses slightly less current than the ordinary domestic electric iron according to the manufacturers.

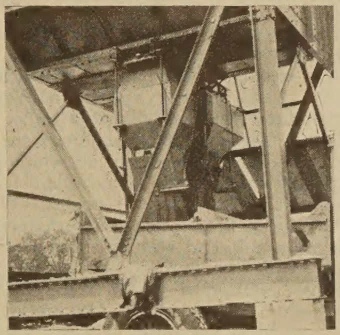


A hardened steel hammer head, which moves back and forth in a bronze barrel is the only moving part of the Syntron electric hammer. On each end of this barrel is a winding of wire which becomes a temporary magnet, alternately, as the current is received; first, one end, then the other, with no mechanical control. This is done by taking advantage of the alternation in the current itself and requires no triggers or mechanical switches. The hammer contains no motors, gears, cranks, eccentrics or connecting rods. The outfit is portable and can be carried like a suitcase from place to place for use wherever alternating current is available.

## Portable Bins

The pictures show the use of a portable steel bin outfit (Butler Equipment Co., Waukesha, Wis.) on paving job of Perry Fess at Whitewater, Wis., one of the views giving a close-up of measuring hoppers dumping into batch truck. This bin is so constructed that it may be set up stationary on concrete piers or the contractor may buy the outfit with wheels and wheel housing, so that bin may be moved fully loaded on the job, enabling a crane to pick up material stored in long windrows.





The measuring hoppers are designed for loading batch trucks or industrial railway cars with the correct amount of coarse and fine aggregates for one batch for any particular mixer. These hoppers are adjustable for any mix from 3 to 6 bags, that is, on one job they can be used for a 3-bag mixer and on the next job they can be used for a 4-, 5- or 6-bag mixer. The hoppers are built of $\frac{3}{16}$-in. plate so as to be strong enough to withstand the rough usage to which contractors' equipment is submitted. They can be attached to either a steel or wood bin. One set of measuring hoppers will load a single batch truck in 10 seconds, a 2-batch truck in 30 seconds and a 3-batch truck in one minute. One man standing on the ground at the bin operates levers, etc.

The steel bin is divided into two compartments for 13 yds. of sand and 26 yds. of stone. It is built so that the bin compartment ships as one unit on a flat car and is therefore easily erected. It is constructed entirely of steel plate ¼ in. thick with heavy angles for stiffeners.

## Monroe Pipe Mold

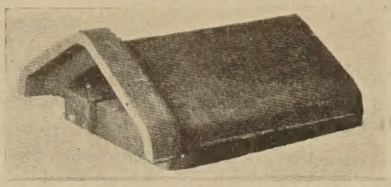
In the description given of the Monroe pipe mold, in CONCRETE for July, definite mention of the inventor was not made. G. K. Monroe, Sidney, Ohio, has worked out his system of production on the basis of a master mold equipment for each size to be made and sufficient outer and inner walls of the galvanized metal for products turned out in one day, together with some 6 to 12 expanding rings and 2 or 3 dozen adjustable braces which are used in holding the inner and outer walls in place.

## Bradt's Building Tile

Bradt's Building tile, illustrated and described in July CONCRETE, was worked out by H. J. Bradt, Rochester, Mich. The tile has a vertical section like a letter U upside down, is cored in such a way as to present a flat, unbroken surface for the horizontal mortar and is made on gang molds on cars.

## Concrete Coping

The picture shows the product of equipment produced by the Ambi Industrial Works, 90 West Street, New York, for making concrete copings for fire walls and so on. There is a constant demand for products of this kind to finish off fire walls. The one outfit offered is complete for making two different sizes, 8-in. and 12-in. It can be moled and colored, much as a roof tile is made and colored and its production might be developed into a profitable side line.



## Books

*A Symbol of Safety*, by Harry Case Brearlay. Size 6 in. x 9 in.; 290 pages; illustrated. Doubleday, Page & Co., Garden City, New York.

This volume comprises a study of the Underwriters' Laboratories, Inc. from its inception about 30 years ago to the present status in which it now embraces the services of 200 engineers and other inside employes, 250 outside inspectors, a plant containing 35,000 sq. ft. of floor space in Chicago, and branch laboratories in New York and San Francisco, a Canadian organization under a Dominion charter, offices in 141 cities and a connection in London.

Various installations of equipment for making tests are described and illustrated, the use of the underwriters' label and the ways in which it is won are explained. Any manufacturer whose product complies with the laboratories' standard may secure listing and the keenest rivals meet upon absolutely common ground.

*Coal Manual for Salesmen, Buyers and Users*, by F. R. Wadley; Size 4½ in. x 6 in.; 184 pages; Price, in cloth binding, $2.50; in leather binding $3.50; National Coal Mining News, Charleston, W. Va.

This book is printed to supply the need of accurate elementary knowledge on the part of salesmen and users regarding coal—its origin, structure, chemistry and uses—as far as possible in an elementary, non-technical and practical way. The actual mining of coal is not touched upon; its problems are technical and administrative and consideration of them would be beyond the intended scope of the Coal Manual.

It gives, fully and in simple language, the information and data that are needed by coal users in purchasing and using coal. A great deal of information is condensed in a very small space.

A bibliography is included, recommending a list of standard books covering different phases of the coal industry, except mining, for those who wish to study the subject in greater detail.

*Foundations, Abutments and Footings*, by George A. Hool and W. S. Kinne. Size 6 in. x 9 in.; 414 pages; illustrated; cloth binding. Price $4.00. McGraw-Hill Book Co. Inc., New York city

Much information is presented in this book never before available in book form. It is the first of a series of 6 volumes designed to provide the beginner in practice and the engineering student with a complete work covering clearly the design and construction of the principal kinds and types of modern civil engineering structures. The information has been compiled by a staff of 19 contributors, specialists in their field.

Beginning with tests to determine soil conditions, various details relative to the design and construction of all kinds of foundations, abutments and footings are included together with data on the various types of equipment used in their construction.

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*The Engineering Index for 1922*, size 6½ in. x 9 in.; 376 pages; cloth binding, price $6.00, with a special price of $5.00 to members of the Am. Soc. of M. E. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York city.

Some 1,300 periodicals, reports and other publications regularly received during the year by the Engineering Societies Library, New York, have been reviewed and from over 600 of these the articles indexed have been selected. The Engineering Index does not give any greater description of an article than is required for the reader to secure an adequate conception regarding its probable value for its purpose.

It is designed to meet the needs of the engineer who is confronted with a problem which may have been worked out recently by someone else and a satisfactory solution, together with valuable reference data, which has been presented in some recent issue of a periodical which the engineer has not had access to.

The information given in the Index enables the user to determine the name, date and address of the publication in which some article in which he is interested, originally appeared. This is a great help in view of the fact that it is manifestly impossible for an engineer to read or even review all of the many technical journals now published in this country and foreign countries. The classification and system of cross-indexing have been perfected and a list of references to bibliographies extended.

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*Structural Members and Connections*, compiled by a staff of specialists, George A. Hool and W. S. Kinne, editors-in-chief. Size 6½ in. x 9¼ in.; 612 pages; illustrated; cloth covers; price $6.00. McGraw-Hill Book Co. Inc., New York city.

This book is the second of a series of six volumes designed to provide the engineer in practice and the engineering student with a complete work covering thoroughly the design and construction of the principal kinds and types of modern civil engineering structures. It is the work of eleven contributors and contains much information never before made available in book form. As the success of a structure to withstand the loading designed for, depends upon the structural members and connections that make up the structure, the proper design of such members is essential. After treating the general theory of design to supply the fundamental knowledge, chapters are devoted to the design of steel and cast iron members, wooden members and reinforced concrete members. In section VI, under the heading, Design of Reinforced Concrete Members, the various members met with in actual practice are taken up in detail.

# The Loan Period for Reinforced Concrete

A letter advocating that loans on reinforced concrete structures should be for as long a period as those for mass concrete as published in *Concrete and Constructional Engineering*, (England), which comments editorially is as follows:

> Is reinforced concrete as permanent as mass concrete? The answer of most careful and conservative engineers would probably be that in favourable circumstances it seems to be so, but that our experience with reinforced concrete does not extend back so far as with plain concrete. By favourable circumstances is meant circumstances where the concrete is first class, made rich enough to be watertight, where only non-porous materials have been used (which excludes broken brick and many broken stones), and where the workmanship and supervision have been above suspicion. It is quite clear that with a porous concrete, or one with insufficient cover, it is only a question of time when corrosion will occur. This time may be long in the case of the inside of buildings in the dry, and short in the case of structures exposed to weather, and shorter still if exposed to sea-water or certain other damaging agents. The introduction of metal inside the concrete obviously introduces an element of risk which is absent in plain concrete. There have been cases in which rods in reinforced floors have corroded in three or four years as a result of the attack of calcium sulfate solution reaching them from a patent plaster. It is true that these are instances of insufficient cover and bad design or workmanship, but it has to be remembered that with mass concrete this danger would not have existed. There are many cases in which the loan period for a reinforced concrete structure might with advantage be increased, but there are also cases when the guarantee of good design, specification and workmanship is somewhat problematical, and unfortunately some reinforced concrete structures have been erected under conditions which invite early decay. Although such buildings are the exception rather than the rule, and are the result of not employing a competent engineer, the growing appreciation of good and careful design will undoubtedly ensure that they are not repeated. While, therefore, a sane review of the position is desirable, it is perhaps a little unfair to decry as "unjust, unreasonable and wasteful" the methods of a Government department which has perhaps been a little careful with a new material, and whose carefulness has in some cases been proved to have been desirable. The most important step to take for those who are interested in extending loan periods is first to ensure that no reinforced concrete structures are erected which are improperly protected against corrosion, overstress, temperature and contraction cracks, etc., and we have still to ascertain whether the Government department concerned would not then deal with a new state of affairs in a more generous spirit.

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# Making Quality Pipe and Block

A letter from Charles R. Chapman of the Concrete Irrigation and Sewer Pipe Factory, Toppenish, Wash., reports that being in a farming and fruit growing district and prices such in the past year that the people are not spending any money for improvements, business is not very good. Irrigation pipe is the company's chief product although some blocks are made.

To keep the concrete right in quality, the company takes special care as to aggregates, proportions, mixing and curing—"removing all dirt from the sand and gravel, grading right and mixing in a Blystone mixer. We cure by sprinkling for 8 days; slower than steam but the concrete is good. All our concrete is cured inside a concrete building, keeping it away from the sun and wind, and the temperature up to 65° all winter by hot water pipes. We use material in concrete pipes in sizes from fine sand up to ⅝-in. gravel and in concrete block from fine sand up to ¾-in. gravel. That is the only way we know to keep the concrete up in quality. For pipe we use 1 part fine sand, 1 part coarse sand, 1 part gravel mixed from ¼ in. to ⅝ in. and 1 part cement. In making block we use 4 ft. fine and coarse sand mixed, 2 ft. mixed gravel from ¼ in. to ¾ in., to the batch and 1 sack of cement; and the face of the block is made of 2 ft. of fine sand and 1 sack cement to the batch."

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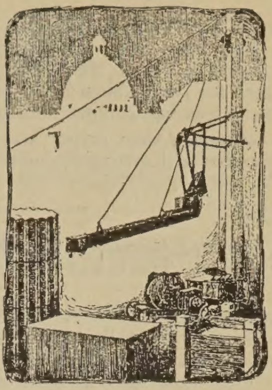

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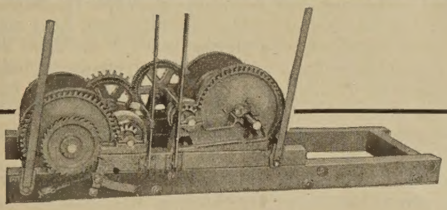

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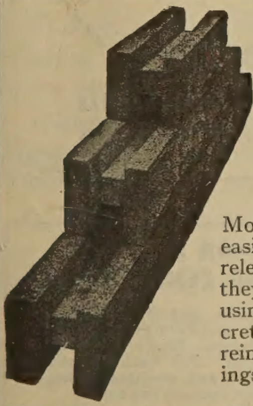

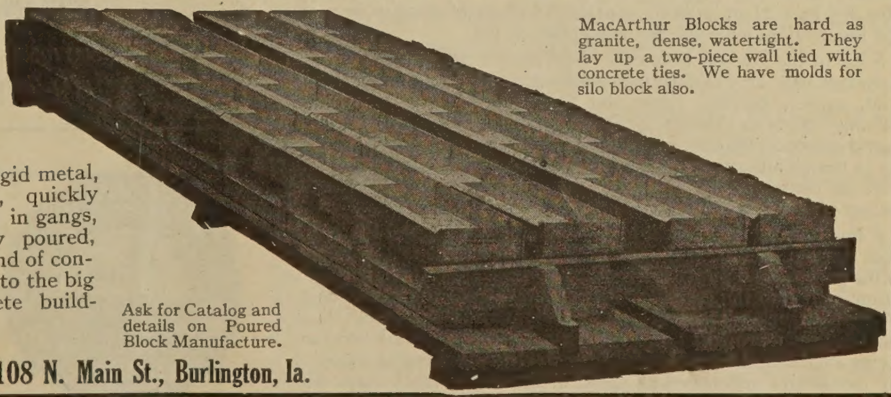

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**MacArthur Cement Products Co. 108 N. Main St., Burlington, Ia.**

# Trade Publications

*Uniflow Boilers*—This booklet by the Lebanon Boiler Works, Lebanon, Pa., descriptive of Uniflow improved return tubular boilers, is 3½ in. x 6¼ in., 24 pp.; paper covers. Among the advantages claimed for the Uniflow boiler are positive circulation, saving in fuel, quick steaming, compactness and large over-load capacity.

Tables of horse-power rating and space required for Uniflow settings, together with setting diagrams for standard installations, are included.

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*Bristol Recording Gauges*, Catalog No. 1006 by the Bristol Co., Waterbury, Conn. This is an 84-page catalog, 8 in. x 10½ in., paper cover.

All ranges from full vacuum to 12,000 lbs. pressure per sq. in. can be taken care of by Bristol's recording pressure and vacuum gauges. The utility of recording gauges, simplicity, partial list of applications, recording liquid level gauges, and long distance transmitting system are discussed in this catalog.

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All the ins and outs and whys and wherefores of remedying defects in plastering by the use of metal lath to avoid cracks and decrease the fire hazard are explained in the publication, "Better Homes," by the Youngstown Pressed Steel Co., Warren, Ohio. There are some very interesting illustrations that should in themselves sell the prospective builder upon the idea of using metal lath in certain vital points of his house construction.

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A trolley folder has just been issued covering the new Yale trolleys. It is the first piece of literature to be issued on this equipment, and contains, in addition to detailed descriptions of the plain and geared types of the new Yale steel plate roller bearing trolleys, a description of the new Yale cast-iron trolley. Incorporated in it are the details of very interesting tests to which the new steel plate trolley was subjected, and a complete list of the material-handling equipment manufactured by the Yale & Towne Mfg. Co.

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The Ottumwa portable handy belt loader is described by the manufacturers, the Ottumwa Box Car Loader Co., Ottumwa, Ia., in a four-page folder with illustrations. This loader is recommended by the manufacturers for loading into box cars, sand and gravel, crushed rock, salt, lime and cement, small coal, sulfur, ores and concentrates, phosphate, fertilizer, grain, etc.

Nothing but roller and ball bearings are used throughout and the equipment is designed as a handy and quick device for raising and lowering to permit entering the smallest cars and also loading to capacity the largest.

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*Architects and Engineers Data Book* by Midwest Steel & Supply Co. Inc. New York City. This book descriptive of Midwest steel sections for overhead layouts and also anchorage of piping, cables, machinery, monorails, car tracks and various other equipment is issued with a view to aiding in solving construction problems relating to overhead shafting layouts in building. The book is 8½ in. x 11 in., 54 pages with paper covers. It is profusely illustrated, showing reproductions of actual installations and sectional drawings for use in connection with the different types of installation.

The Midwest steel sections comprise ankerails, concrete inserts, and steel stringers which have demonstrated their practicability over a period of years and are now in actual use and operation in a large number of plants distributed throughout the country.

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*Byers TrucKrane*, by the Byers Machine Co. Ravenna, Ohio. This 8½ in. x 11 in. bulletin contains 16 pages of descriptive matter and illustrations showing the truckrane in use.

Some of the jobs for which the truckrane is recommended by the manufacturers are: unloading, stocking, re-handling and re-loading sand, gravel, crushed stone and light materials for contractors, building supply dealers, etc.; excavating and cleaning up after steam shovel or excavating the entire job in small basement work; excavating in trench and other contract jobs; driving piles and doing similar work on contract jobs; stripping, excavating, loading, backcasting, etc., at pit for sand and gravel producers.

A five ton or larger truck, having a minimum length of 9 ft. 6 in. from rear of drivers seat to center of rear axle can be readily adapted to the purpose and power is furnished by high-grade 35 h. p. gasoline motor built into the crane, entirely separate from the power unit of the motor truck. The truckrane is mounted on the truck chassis, the truckrane providing the capacity, operating speed and labor-saving mechanical features of a rugged, sturdy industrial crane, plus the movability and traveling speed of the motor truck upon which it is mounted.

*The Albatross, No. 61*, is about White truck service, the White Co., Cleveland. It consists of 24 pages including cover in colors, 8½ x 11 in., with many illustrations, describing the performance of White trucks and the service that is maintained by the White organization in order to sustain that performance.

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The sixth edition of *The Waterproofing Handbook* published by The General Fireproofing Co., Youngstown, O., is a reference book 8½ in. x 11 in., 72 pages conveniently arranged for the quick location of the answer to any waterproofing problem and illustrated by reproductions of drawings and photographs.

The book is sub-divided into four distinct parts, each section dealing with related problems of waterproofing: Section I, sub-structural waterproofing, deals with the waterproofing of foundations, basements, pits, tanks, pools and containers and other structures subjected to hydrostatic pressure and dampness; Section II deals with super-structural waterproofing; Section III with cement and wood floor preservation; and section IV with technical paints and coatings.

Complete specifications are given for all problems and the book is completely indexed to aid in the location of any problem or specification.

The book is for free distribution to architects, engineers and contractors who are confronted with waterproofing or dampproofing problems.

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*Miles Concrete Equipment*, The Miles Manufacturing Co., Jackson, Mich.; 48 pages and cover, 7½ x 10½ in.; very profusely illustrated showing the Miles equipment, details of its operation in making block both by hand tamping and machine tamping, mixers, brick machines and molds for specials of various kinds. The Miles line includes equipment for making both tamp block and wet cast block. The catalog shows numerous illustrations of buildings erected with concrete units and gives some plans for concrete block houses.

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*The Water Supply for Swimming Pools* is the title of bulletin No. 500 issued by the Graver Corporation, East Chicago, Ind., containing a description of Graver water softening and purification equipment with data on design, construction and operation of swimming pools.

The bulletin is 8½ in. x 11 in. with 16 pages. Considerable interesting information about the filtration, heat and disinfection of the water supply for swimming pools is included and it is pointed out that increased interest is being given to swimming and bathing as evidenced by the large number of pools being built. The safety and sanitation of bathing facilities for which the Graver equipment is recommended is being brought up by various organizations throughout the country.

Included in the data given in the bulletin are reproductions of three actual layouts of installations designed for Graver equipment.

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